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NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 7 April 15, 1958

GENERAL

4644

UNITED STATES AND BRITAIN REVEAL FUSION ADVANCES. Nucleonics 16, No. 2, 90-3(1958) Feb.

The reports recently released on thermonuclear experiments are discussed. The experiments are evaluated with respect to their practicality and possible peaceful use. (J.S.R.)

4645

DETAILED DESCRIPTIONS OF PINCH-EFFECT DEVICES. Nucleonics 16, No. 2, 93, 151-5(1958) Feb.

The Los Alamos device known as Columbus II was designed as a high-powered machine in which the current reached its maximum in as short a time as possible. The machine is described, and the results obtained are given. Using the low-voltage bank, short neutron bursts were produced at the time of the first and second pinch and with the high-voltage bank, at the time of the first pinch. The Columbus S-4, a linear discharge device, was constructed to test the effect of increased tube diameter and interelectrode spacing on the properties of a B_z-stabilized pinched discharge. The Perhapsatron S-3, with a toroidal geometry, attempts to gain stability by a combination of a central axial magnetic field and conducting walls. Some positive results have been obtained. Preliminary results from the ZETA, an English device, demonstrate that it is possible to maintain H_2 gas in a state of almost complete ionization with a particle density between $10^{13} - 10^{14}/cm^2$. The electrical characteristics, stability, and neutron production are discussed. A brief description of the Sceptre III is given. (J.S.R.)

Atomic Power

4646

NUCLEAR POWER IN EUROPE. Andrew W. Kramer (Power Engineering, Chicago). Metal Progr. 73, No. 1, 76-82(1958) Jan.

The treaty instituting the European Atomic Energy Community is described. The construction of power stations and reactors in Great Britain and Europe is described. (W.L.H.)

4647

UNDERSTANDING NUCLEAR POWER COSTS. WHERE WE STAND TODAY. James A. Lane (Oak Ridge National Lab., Tenn.). Nucleonics 16, No. 1, 46-7(1958) Jan.

Operating experience from prototype reactors now being constructed seems necessary before low-cost-power projections are truly realistic. Available data, however, indicate that 10-mill nuclear power in the U. S. is still a possibility in the not too distant future. (L.M.T.)

4648

THE ECONOMIC SITUATION AS VIEWED BY THE AEC. Nucleonics 16, No. 1, 48-9(1958) Jan.

Several pertinent questions on nuclear power costs are answered by W. Kenneth Davis, Director, Division of Reactor Development, AEC. (L.M.T.)

4649

SIZING UP UNCERTAINTIES IN NUCLEAR FUEL COSTS. Nucleonics 16, No. 1, 50-3(1957) Jan.

A study of fuel costs for a PWR-type reactor reveals a factor-of-three uncertainty brought about principally by spread in Pu credits and fabrication charges. (auth)

4650

PRICING ENRICHED URANIUM. Hal L. Hollister and Artha Jean Burington (U. S. Atomic Energy Commission, Washington). Nucleonics 16, No. 1, 54-7(1958) Jan.

An analysis of separation-plant economics yields the published U price scale, explains how to calculate equivalent amounts of U at different enrichment and leads to a simple method for estimating reactor fuel burnup cost. (auth)

4651

CHARTING A COURSE FOR NUCLEAR POWER DEVELOPMENT. Karl Cohen (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 1, 66-70(1958) Jan.

A rational approach to long-term reactor economics is proposed that stresses the role of realistic material and capital costs. Three reactor types are discussed to illustrate the approach, namely: the water-moderated enriched U-fueled reactor; the graphite-moderated natural-uranium-fueled reactor; and the heavy-water-moderated, natural uranium-fueled reactor. (L.M.T.)

4652

THE OUTLOOK FOR INDUSTRIAL HEAT REACTORS. Nucleonics 16, No. 2, 62-4(1958) Feb.

As more energy is used for industrial heating in the U. S. than for the production of electricity, the application of nuclear reactors to this problem is being considered. The design of both low-temperature (400°F) and high-temperature reactors (1500°F) would be governed by economic factors rather than by technical requirements. The economics involved are discussed. (J.S.R.)

4653

AEC'S INDUSTRIAL-HEAT PROGRAM. J. F. Kaufman and D. H. Stewart, Jr. (U. S. Atomic Energy Commission, Washington). Nucleonics 16, No. 2, 65(1958) Feb.

As industrial process-heat reactors, when built, will be designed and engineered for a specific process, the AEC

is emphasizing the development of a general high-temperature test reactor. A conceptual design study has been made. In addition, a high-temperature He test loop is being developed in cooperation with the Bureau of Mines. (J.S.R.)

4654

THE MARKET FOR HEAT REACTORS. Karl M. Mayer (ACF Industries, Inc., Washington). Nucleonics 16, No. 2, 66-7(1958) Feb.

The results of a recent market analysis of the heat consumed in 460 industries are given. The potential industrial heat market for reactors is discussed. (J.S.R.)

4655

NUCLEAR HEAT FOR PAPER MILLS? George Perazich (National Planning Association, Washington). Nucleonics 16, No. 2, 68(1958) Feb.

The paper and pulp industry is discussed as a potential customer for heat reactors. (J.S.R.)

4656

A LOW-COST HEAT REACTOR. Nucleonics 16, No. 2, 69(1958) Feb.

A conceptual design for an all-purpose, low-pressure, steam-generating, low cost heat reactor is discussed. (J.S.R.)

4657

HEAT REACTOR PROSPECTS ABROAD. Nucleonics 16, No. 2, 70-1(1958) Feb.

The possible use of industrial heat reactors in Norway, Sweden, and Great Britain is discussed. (J.S.R.)

Research Programs

4658 DOW-162

Dow Chemical Co. Western Div., Pittsburg, Calif.
A REVIEW OF THE RESEARCH PROGRAM OF THE DOW CHEMICAL COMPANY FOR THE RAW MATERIALS DIVISION OF THE U. S. ATOMIC ENERGY COMMISSION. Final Report. David A. Ellis. Sept. 30, 1957. 36p. Contract AT-30-1-GEN-236. $6.30(ph OTS); $3.00(mf OTS).

A summary of the research work done over a $9\frac{1}{2}$ year period and lists of reports and publications are given. The research program involved the development and application of ion exchange, solvent extraction and other methods to the recovery of uranium and other values from ores and leach solutions and exploratory studies on processes for manufacture of reactor-grade UF_4 at ore-processing mills. (auth)

BIOLOGY AND MEDICINE

Radiation Effects

4659 PB-131171

Office of the Quartermaster General, Fort Lee, Va.
STATUS REPORT TO MANAGEMENT ON RADIATION PRESERVATION OF FOOD. W. D. Jackson. July 1, 1957. 16p.

4660 USNRDL-TR-192

Naval Radiological Defense Lab., San Francisco.
THE EFFECT OF SUBLETHAL TOTAL BODY IRRADIATION ON THE BACTERICIDAL ACTIVITY OF RAT LEUCOCYTE MITOCHONDRIAL EXTRACTS. M. Fishman and M. S. Silverman. Dec. 2, 1957. 14p. Project No. NM-006-015.04.

Two different groups of rats were exposed to 300 and 500 r total-body x irradiation. Mitochondrial extracts were prepared from the leucocytes of these animals at various post-irradiation days. The bactericidal activity of these extracts was determined and compared to the activity obtained with extracts prepared from leucocytes from non-irradiated animals. The results showed that irradiation decreased the bactericidal activity per leucocyte, with the maximum depression occurring between the 3rd and 5th days after exposure. Recovery of the bactericidal activity was evident between the 8th and 12th post-irradiation day in the 300 r group but was not noted in the 500 r group even on the 30th day after irradiation. (auth)

4661 USNRDL-TR-194

Naval Radiological Defense Lab., San Francisco.
EFFECTS OF X-IRRADIATION ON LIPID METABOLISM. IV. LIPOGENESIS FROM ACETATE-C^{14} BY THE LIVER. W. L. Warner, S. R. Lerner, and C. Entenman. Oct. 23, 1957. 29p.

Rats, mice, and guinea pigs were subjected to whole body x-irradiation and the uptake of C^{14} from acetate-C^{14} into liver lipids and exhaled CO_2 was determined. The conversion of acetate-C^{14} to lipid C^{14} in liver slices prepared 24 hours after irradiation was increased as much as 20 fold in rats, 2 fold in guinea pigs, and not at all in mice. The changes noted were roughly correlated with the levels of liver glycogen. The data offer a possible explanation for the previously observed increases in blood lipid levels following x-irradiation. (auth)

4662 USNRDL-TR-195

Naval Radiological Defense Lab., San Francisco.
EFFECT OF FRACTIONATION OF BETA RADIATION UPON RAT SKIN. Elly M. Jacobsen, A. K. Davis, and Edward L. Alpen. Sept. 25, 1957. 25p.

Female rats were exposed to a Sr^{90}-Y^{90} plaque at a skin dose rate of 14.6 rad/sec. Four dose fractions of 200, 400, 600, and 1000 rad were given at either 24 or 48 hour intervals to obtain total doses of 6,000 or 12,000 rad. A grading and scoring system was devised and the animals were observed daily until healing was complete. Data are tabulated. (auth)

4663

NONGENETIC EFFECTS OF RADIATION ON MICROORGANISMS. R. F. Kimball (Oak Ridge National Lab., Tenn.). Ann. Rev. Microbiol. 11, 199-220(1957).

Recent studies on the physiological and biochemical effects of radiation on microörganisms are reviewed. (C.H.)

4664

CELLULAR RADIOBIOLOGY. E. L. Powers (Argonne National Lab., Lemont, Ill.). Ann. Rev. Nuclear Sci. 7, 63-88(1957)

4665

BIOCHEMICAL EFFECTS OF IONIZING RADIATION. Barbara E. Holmes (Univ. of Cambridge, Eng.). Ann. Rev. Nuclear Sci. 7, 89-134(1957).

4666

VERTEBRATE RADIOBIOLOGY (LETHAL ACTIONS AND ASSOCIATED EFFECTS). V. P. Bond and J. S. Robertson (Brookhaven National Lab., Upton, N. Y.). Ann. Rev. Nuclear Sci. 7, 135-62(1957).

4667

VERTEBRATE RADIOBIOLOGY (THE PATHOLOGY OF RADIATION EXPOSURE). C. C. Lushbaugh (Los Alamos Scientific Lab., N. Mex.). Ann. Rev. Nuclear Sci. 7, 163-84(1957).

4668

DYNAMICS OF PERIPHERAL BLOOD CELLS IN MICE EXPOSED TO X RADIATION UNDER CONDITIONS OF

SCREENED EXTREMITY AND IN A LOCAL EXPOSURE. Z. N. Faleeva (Severtzov Inst. of Animal Morphology, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 785-7(1957) Oct. 11. (In Russian)

4669

ADVANCES IN RADIOBIOLOGY. Proceedings of the Fifth International Conference on Radiobiology held in Stockholm on August 15-19, 1956. George Carl de Hevesy, Arne Gunnar Forssberg, and John D. Abbatt, eds. Edinburgh, Oliver and Boyd, 1957. 513p.

Topics discussed at this conference include: the initial or primary effects of irradiation on enzymes and other cellular constituents; physiological and morphological changes induced by irradiation; alpha particle irradiation of single cells; modification of systemic irradiation effects; the time factor in radiobiology; studies on the distribution of isotopes in tissues; irradiation effects on the hematopoietic system; and radiation genetics. (C.H.)

4670

THE FUNCTION AND CAPACITY OF THE ADRENAL CORTEX IMMEDIATELY BEFORE RADIATION SICKNESS DEATH. George Rosenfeld (National Navy Medical Center, Bethesda, Md.). J. Lab. Clin. Med. 51, 198-210(1958) Feb.

Radiation Hazards and Protection

4671 AF-SAM-58-18

Utah. Univ., Salt Lake City. Coll. of Medicine.

THE EFFECT OF X-IRRADIATION ON PREFORMED ANTIBODY AND ITS ROLE IN THE PROTECTION OF X-IRRADIATED MICE. Eugene H. Perkins and Stanley Marcus. Aug. 15, 1957. 7p.

Induced agglutinin titers for human type A erythrocytes were not decreased by exposure to 300, 500, or 700 r of total-body x irradiation 3, 7, 11, or 15 days following radiation exposure in albino rats. Antibody derived from mice exposed to x irradiation did not lose capacity to effectively protect against infection. Passive immunization of normal (nonirradiated) or 300 or 400 r x-irradiated animals proved just as effective a measure for protection as did active immunization. At higher levels antibody (passive immunization) afforded no protection. The possible roles of antibody and cells in the irradiated animal are discussed. (auth)

4672 NYO-2071

New York Operations Office. Health and Safety Lab., AEC.

HASL AERIAL SURVEY SYSTEM. M. E. Cassidy, R. T. Graveson, and H. D. LeVine. July 29, 1957. 58p. $1.75 (OTS).

Radioactive debris from nuclear detonations may fall out over an extensive area. A rapid evaluation of the distribution of such surface contamination can be obtained by an aircraft mounted detector. The gamma field measured in the aircraft can be related to the intensity on the ground. The HASL "Top Hat" system measures the radiation intensity, in an aircraft, at any altitude up to 1500 feet. The data are continuously compensated to the reading that would be obtained if the measurements were taken at three feet from the ground surface. It will record the ground radiation field intensities from 0.01 mr/hr to 1000 r/hr. The Telepulse Coding Unit converts this information to a signal suitable for transmission to a plotting center via a standard voice radio transmitter. The transmitted signal is decoded by a Telepulse Receiving Unit and is automatically recorded on a strip chart. The radiation data must be correlated with the aircraft position to determine the location and intensity distribution of the contaminated area. (auth)

4673 UCRL-3703

California. Univ., Berkeley. Radiation Lab.

HUMAN AND CATTLE THYROID RADIOACTIVITY ASSOCIATED WITH FALLOUT: OCTOBER 1955 TO OCTOBER 1956. Margaret R. White. Mar. 1, 1957. 15p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Thyroids from humans, obtained at autopsy, were followed for radioactivity from January 1956 to October 1956. There is less than one chance in one thousand that human thyroid tissue could have been irradiated to the extent of 0.001 rep from I^{131} fallout. The probable value is no more that 0.00016 rep during this period. Thyroids from cattle slaughtered in the San Francisco Bay Area were followed for radioactivity from October 1955 to October 1956. Two periods of increase in radioactivity, possibly due to small-yield detonations in Nevada, were seen in December 1955 and January 1956. A period of high activity in cattle thyroid, probably due to a Russian detonation, began in March, and radioactivity from this delivered a maximum of 0.2 rep. Another period of high activity, presumably due to the Bikini tests, began in May 1956 and was continuing at the time this report ended. It delivered (up to October 11, 1956) a maximum of approximately 1.3 rep to cattle thyroid tissue. This level of radiation exposure would produce no change in physiological function of the thyroid and would not be detrimental to cattle. (auth)

4674 USNRDL-TR-182

Naval Radiological Defense Lab., San Francisco.

A STUDY OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIOACTIVE FALLOUT IN WATER AND AIR BASED UPON MILITARY EXPOSURE CRITERIA. J. D. Teresi and C. L. Newcombe. Aug. 27, 1957. 136p. [Project] NS-083-001.

Maximum permissible levels in water and air were calculated for gross fall-out material based on military dose criteria of 15 rem in 90 days and 150 rem in 30 days. The fourteen major radionuclides that compose the mixed fall-out material were considered. Maximum permissible concentrations (MPCs) for each radioisotope are expressed for 7 periods of intake (1, 7, 14, 21, 30, 60, and 90 days) and for 11 times after fission (3.5 and 12 hours, and 1, 2, 4, 7, 14, 28, 105, 210, and 365 days). Tabulations of the relative contributions to the fall-out mixture made by the five principal radioisotopes are expressed in percent of the major contributor which is taken to be 100%. These percentages are based on the MPC data for different exposure periods and times after fission. The method of evaluation can be readily applied to other dose criteria and corresponding MPCs are obtainable by applying the appropriate factor. The computations have established that, during the first month after fission, the mixed fall-out material is a hazard mainly because of five constituents: I^{131}, Np^{239}, Sr^{89}, Zr^{95}, Nb^{95}, and Y^{91}. (auth)

4675 AEC-tr-3122

MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIOACTIVE ISOTOPES. (Zur Frage der Maximal Zulässigen Konzentrationen Radioaktiver Isotope). A. Catsch. Translated from Atomkern-Energie 2, 181-6(1957). 23p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 11, as abstract No. 12653.

4676

PUTTING SAFETY INTO GAGING-SOURCE DESIGNS. George B. Foster (Industrial Nucleonics Corp., Columbus, Ohio). Nucleonics 16, No. 2, 128, 130(1958) Feb.

The means used to protect personnel from injection of and external exposure to radioactive materials in gaging operations are described. (J.S.R.)

Radiotherapy

4677
A METHOD OF CORRECTION FOR EXTRATHYROIDAL RADIOACTIVITY. A. W. G. Goolden and J. R. Mallard (Hammersmith Hospital, London). Brit. J. Radiol. 31, 41-4(1958) Jan.

A method of correction for extrathyroidal radioactivity has been determined which can be applied to the early measurement of thyroid uptake with radioiodine. An investigation has been carried out on ten thyroidectomized patients. The change in radioactivity in a given volume of neck tissue has been compared with that in the same volume of thigh tissue and a neck-thigh ratio (N/T) obtained. The N/T ratio has been satisfactorily applied to the measurement of early thyroid uptake and clearance rate on 40 normal or hypothyroid patients. (auth)

4678
ISOTOPE MANUAL FOR THE PHYSICIAN. AN INTRODUCTION TO THE MEDICAL APPLICATION OF ISOTOPES. Walter Beier and Erich Dorner. Leipzig, Veb Georg Thieme, 1957. 201p. (In German)

Toxicology Studies

4679
DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS. N. Irving Sax. New York, Reinhold Publishing Corporation, 1957. 1473p.

Approximately 9,000 chemicals are listed, and available information is included on the physical properties, formula, constants, toxicity, fire hazard, explosion hazard, disaster control, ventilation control, personnel protection, personal hygiene, first aid, and storage and handling. An introductory discussion of toxicology is presented. Other topics discussed include ventilation control; personnel protection and personal hygiene; atmospheric pollution; radiation hazards; industrial fire protection; the storage and handling of hazardous materials; reactor safeguards; allergic disease in industry; and shipping regulations. An index to synonyms is included. (C.H.)

Tracer Applications

4680
ABSORPTION AND DISTRIBUTION IN RATS OF RADIOACTIVE PHOSPHORUS BIOLOGICALLY INCORPORATED IN FOOD. B. Kawin and R. F. Palmer (General Electric Co., Richland, Wash.). Nature 181, 127-8(1958) Jan. 11.

4681
THE RELEVANCE OF THE SKELETAL BURDEN OF THOROTRAST TO THE PROBLEM OF CHRONIC TOXICITY OF BONE SEEKERS IN MAN. L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Radiology 70, 93-4 (1958) Jan.

CHEMISTRY

4682 AECD-4251
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PROCEDURE FOR GENERATION OF BORON TRIFLUORIDE GAS. O. Swift. July 28, 1954. 1st. Rev. Dec. 11, 1954. Changed from OFFICIAL USE ONLY Sept. 26, 1957. 5p. (PS-AP-292265). $1.80(ph OTS); $1.80(mf OTS).

A procedure is described for the preparation of pure BF_3 gas, suitable for use in BF_3 proportional neutron counters. (W.L.H.)

4683 AECU-3277
Princeton Univ., N. J.
PRACTICAL DETERMINATION OF FLAME SPEEDS WITH NEGLECT OF DIFFUSION. David Layzer and Robert H. Goerss. [1952?]. 5p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-4). $1.80(ph OTS); $1.80(mf OTS).

4684 AECU-3283
Princeton Univ., N. J.
SINGLE REACTION FLAMES: APPROXIMATE DETERMINATION OF FLAME SPEEDS AND FLAME WIDTHS. David Layzer. Apr. 13, 1953. 10p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-10). $1.80(ph OTS); $1.80(mf OTS).

A method, which neglects the effects introduced by the physical dissimilarity between the molecules of the reactant constituent and the molecules of the product constituent, is described to approximate the flame widths and the flame speeds for first and second order flames. (J.S.R.)

4685 AERE-CE/R-2215
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PREPARATION AND PROPERTIES OF THE CHLORIDES OF URANIUM, PLUTONIUM, AND THORIUM, AND OF THE FISSION PRODUCT CHLORIDES. D. Bradley. Aug. 1954. Nov. 1956. 53p.

4686 CF-58-1-93
Oak Ridge National Lab., Tenn.
THE REACTIONS OF MAGNESIUM AND MAGNESIUM ALLOYS WITH GASES AT HIGH TEMPERATURES. H. Inouye. Jan. 20, 1958. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The ignition temperature of Mg is influenced by numerous variables of which the most important appear to be alloying (or dissimilar metal contact) and the concentration of the Mg vapor over the heated metal. Most alloying elements lower the ignition temperature; however, Be additions inhibit the pyrophoricity of alloys up to temperatures in excess of their melting point. Although there is evidence that the ignition temperature of Mg is O_2-pressure sensitive, its effects are slight in comparison to the above factors. Similarly, the changes observed in the ignition temperature resulting from changing the corrosive gas to CO_2 and SO_3 are slight. The corrosion products resulting from decomposition of these gases are MgO and C for atmospheres composed of CO_2, air, and O_2, and $MgSO_4$ in the case of SO_2 atmospheres. Moisture in the above gases accelerates the corrosion rate. In CO_2, the rate is increased by moisture by a factor of 4 in one month to a factor of 2 after two months. There is no information on the effect of moisture on the ignition temperature; however, if the correlation between oxidation rates and ignition temperatures is still valid, it is expected that moisture will lower the ignition temperature. For fuel elements of U canned in Mg, it is believed that the real hazard in case of a can failure due to excessive temperature is the pyrophoricity of U, which ignites at 350°C in air. (auth)

4687 IDO-14423
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THE OXIDATION OF MERCURY BY NITRIC ACID. R. F. Murray and H. Schneider. Nov. 30, 1957. 24p. Contract AT(10-1)-205. $0.75(OTS).

The oxidation of Hg in HNO_3 was investigated. An empirical rate law, oxidation rates, and Hg species in solu-

tion were determined. A reaction mechanism based on the presence of nitrous acid can be interpreted in terms of the rate expression derived. (auth)

4688 LA-2147

Los Alamos Scientific Lab., N. Mex.

SAFETY CONSIDERATIONS FOR HANDLING PLUTONIUM, URANIUM, THORIUM, THE ALKALI METALS, ZIRCONIUM, TITANIUM, MAGNESIUM, AND CALCIUM. Ellis L. Stout, comp. Sept. 4, 1957. 24p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

This report compiles from various sources safety considerations for work with the special metals plutonium, uranium, thorium, the alkali group, magnesium, titanium, calcium, and zirconium. General criteria to be observed in handling all of these metals and their alloys are listed, as well as characteristics of individual metals with regard to health hazards, pyrophoricity, explosiveness, and other chemical reactions, in both handling and storage. (auth)

4689 NBS-5325

National Bureau of Standards, Washington, D. C.

REACTIONS OF THE GLYCOSYLAMINES. Horace S. Isbell and Harriet L. Frush. Dec. 1, 1957. 41p. $1.25 (OTS).

The mutarotation, hydrolysis, and rearrangement reactions of D-glucosylamine, D-mannosylamine, and D-xylosylamine were studied and rationalized on the basis of the formation of an intermediate acyclic imonium ion. Rate constants are given for the hydrolysis reactions under various conditions. The formation of diglycosylamines is explained as a type of transamination in which a second molecule of the glycosylamine reacts with the first (in the imonium ion form) with the subsequent elimination of ammonia. Unsubstituted D-glucosylamine was found to undergo an Amadori rearrangement in glacial acetic acid or in some of the methylenic compounds found to be effective in the rearrangement of N-substituted glycosylamines. Intramolecular mechanisms are suggested to account for the effectiveness of carboxylic acids and methylenic compounds in promoting the Amadori rearrangement. The mechanisms provide a means for transferring an enolic structure from a catalyst to the amine. (auth)

4690 NP-6542

MSA Research Corp., Callery, Penna.

THE FORMATION OF CHROMATE "YELLOW" WATER IN HIGH PRESSURE WATER SYSTEMS. Technical Report No. 60. R. Gagne and E. F. Batutis. Jan. 17, 1958. 24p. Contract NObs-65426.

Appearance of yellow water in water cooled reactor systems indicated Cr^{+6} ion was being formed. The relative importance of neutron flux and/or chemical reaction was not known; hence a study has been made of the latter to determine the effect of dissolved oxygen, pH and chromium source material on the formation of chromate in water at 500°F, 1000 psig. Three 2-liter Magnedash autoclaves were used to study chromate contribution from stainless steel, chrome-plate and crud at pH 4.5, 7 and 9.5. The range of dissolved oxygen concentrations studied was 8 to 15 ppm. The neutral and acid autoclaves did not produce chromate from any source except during intermittent operation. Chromate was produced from all sources in the basic system in concentrations depending on oxygen level; the maximum produced under any condition was 25 ppm Cr^{+6}. Chromate concentrations do not persist but drop as oxygen disappears. (auth)

4691 PRL-5.21

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for April, May, and June 1957. June 29, 1957. Includes Appendix A: DIESTERS AS HIGH TEMPERATURE HYDRAULIC FLUIDS. E. E. Klaus and M. R. Fenske. Apr. 8, 1957. 98p. Contract AF33(616)-2851.

An evaluation is presented of the effect of super-refining, principally hydrogenation, on various properties of mineral oils and hydrocarbons. The types of fluids evaluated include naphthenic neutrals, paraffinic neutrals, and bright stocks, Pennsylvania bright stocks, and condensed aromatic hydrocarbons. The effect of hydrogenation on the composition and on properties such as viscosity, viscosity-temperature relationship, density, and refractive index was determined. Behavior of the various fluids was evaluated with respect to thermal stability. (W.L.H.)

4692 RDB(C)/TN-32

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

THE OXIDATION OF URANIUM IN AIR: A REVIEW OF PROGRESS TO FEBRUARY 27, 1953. K. Q. Bagley and D. S. Oliver. June 5, 1953. Decl. Sept. 3, 1957. 42p.

The kinetics of the oxidation of U in air have been investigated in the temperature range 150 to 500°C by gravimetric, metallographic and x-ray methods. Data were obtained on the rate of oxidation, the composition of the scale, and the superficial changes in the scale at different temperatures. A brief survey was made of the rate of reaction of U in pure N. The data indicate that the mode, as well as the degree of oxidation, changes as the temperature rises and activation energies have been evaluated for the processes successively controlling the rate of reaction. (auth)

4693 SEP-207

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

A CONTINUOUS ELECTROLYTIC PROCESS FOR THE PRODUCTION OF BERYLLIUM METAL. M. C. Kells, R. B. Holden, and C. Whitman. Apr. 23, 1956. Decl. May 18, 1956. 43p. Project No. 1562. Contract AT-30-1-GEN-366. $0.30(OTS).

A brief description of the process is given, and details of work over a three-year period are summarized. The continuous production of Be metal by low-temperature fused salt electrolysis into a continuously circulating Hg cathode has been demonstrated. The product is amenable to direct hot pressing or to powder preparation by distilling off the Hg. The production of pure $BeCl_2$ in good yield by direct chlorination of BeO has been demonstrated. The production of pure $BeCl_2$ in good yield by direct chlorination of beryl has been studied. The status of this work is not sufficiently advanced to permit valid conclusions as to ultimate success. The electrolytic cell and associated equipment and the chlorination equipment are described in detail. Operating procedures and representative results are given. The course for continued work is indicated. (auth)

4694 WADC-TR-57-606

Denver. Univ. Denver Research Inst.

ORGANIC COMPOUNDS OF GALLIUM: A SUMMARY OF THE LITERATURE. [Period covered] November 1956 to June 1957. Andrew J. Frank, Richard W. Sullivan, and Virgil W. Lichtenberg. Sept. 25, 1957. 26p. Project title: HYDRAULIC FLUIDS. Contract AF33(616)-2939. (AD-142158).

The literature concerning organic compounds containing Ga has been surveyed, and the properties of all organometallic and organic coordination compounds of Ga are summarized. An annotated bibliography of all references is provided. (auth)

4695 AEC-tr-3120

RAMAN SPECTRA OF THE SYSTEMS $ZnCl_2$–KCl AND $CdCl_2$–KCl IN THE MELT. W. Bues. Translated by G. M. Wolten from Z. anorg. u. allgem. Chem. 279, 104-14 (1955). 16p.

The layers, constituting the crystals of zinc chloride and cadmium chloride, are largely maintained in the melt. Force constants in complexes and in pure melts are compared. A Raman lamp for work up to 850°C is described. (auth)

4696 AEC-tr-3127

METAL HYDRIDES. II. HYDRIDES OF EARTH ALKALI METALS AND OF LITHIUM. Fritz Ephraim and E. Michel. Translated from Helv. Chim. Acta 4, 914-20 (1921). 8p.

The oxides of Ba and Sr were prepared (precautionary measures were used to prevent carbonate formation) and were then heated in H_2 with an excess of Mg. For Sr the reaction occurred according to the rate of heating at 500 to 540°C; for Ba on investigation at 377°, in another at 490°C. Rather complete data are given regarding the reactions, consumption of H_2, yield, etc. (L.M.T.)

4697 AEC-tr-3138

THE INFRA RED SPECTRUM AND THE STUDY OF WATER IN SOLIDS. PART I. GENERAL INTRODUCTION AND STATUS OF THE PROBLEM. (Le Spectre Infragouge et L'Etude de L'Eau Dans les Solides. I. Introduction Générale et position de la Question). Jean LeComte. Translated from J. chim. phys. 50, 53-71(1953). 34p.

A study is presented of the inter- or intramolecular bond between solid compounds and water, using the infrared spectrum. (W.L.H.)

4698 NP-tr-24

THE ALLEGED ALLOTROPY OF LIQUID NITROBENZENE. Ernst Cohen and L. C. J. te Boekhorst. Translated by E. Wait from Z. physik. Chem. 24B, 241-58(1934). 15p.

4699 NP-tr-28

PHYSICO-CHEMICAL METHOD OF EVALUATION OF THE REACTION OF FLOTATION REAGENTS WITH THE SURFACE OF MINERAL GRAINS. V. M. Borisov. Translated from Khim. Prom., 336-8(1954). 8p.

4700

THE NUCLEIC ACIDS. Waldo E. Cohn and Elliot Volkin (Oak Ridge National Lab., Tenn.). Ann. Rev. Biochem. 26, 491-522(1957).

Recent work in the fields of nucleic acid structure, the relation of nucleic acids to physiological and metabolic events, and biological interventions are summarized. (C.H.)

4701

BIOCHEMISTRY IN THE U.S.S.R. Jakob A. Stekol (Lankenau Hospital Research Inst. and Inst. for Cancer Research, Philadelphia, Penna.). Ann. Rev. Biochem. 26, 611-44(1957).

A summary is presented of recent Soviet articles in the field of animal biochemistry. Reports on the effects of ionizing radiations on plants and animals were omitted. (C.H.)

4702

GATHER SAFETY KNOW-HOW IN BORON HANDLING. William H. Schechter (Callery Chemical Co., Penna.). Ind. Lab. 9, 6-8(1958) Jan.

The research and development on handling and safety of boron compounds by Callery Chemical Co. are reported. (W.L.H.)

4703

THE SOLUBILITY OF WATER IN MOLTEN MIXTURES OF LiCl AND KCl. William J. Burkhard and John D. Corbett (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 6361-3 (1957) Dec. 20.

The solubility of water in molten mixtures of 50.0, 53.0, 60.0, and 68.6 mole % LiCl in KCl has been determined at 480°, and 50.0 and 60.0% at 390°, over the pressure range 3 to 26 mm. The solubility follows Henry's law to 18 mm. at 480° and 14 mm. at 390°. The reciprocal Henry's law constants are, respectively, 14, 11.8, 11.3, and 10.8 micromoles water per mole LiCl per mm. at 480°, and 30.0 and 30.5 at 390°. Heats of solution of −8 and −11.0 kcal. $mole^{-1}$ are calculated for the 50 and 60% compositions, respectively. The solubility at 480° exhibits a sharp upward break beyond 18 mm. due to hydrolysis of the LiCl at the higher water pressures. At 390° no such behavior is observed, but only a slight upward deviation above about 14 mm. The uniqueness of the lithium ion in this process, and the unusual tenacity with which water is retained by the melt are discussed. (auth)

4704

FRAGMENTATION OF METHANE BY ELECTRON IMPACT, AND THE LATENT HEAT OF SUBLIMATION OF CARBON. J. D. Morrison (Univ. of Chicago, Ill.) and H. E. Stanton (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 28, 9-11(1958) Jan.

The ions produced in the fragmentation of methane by electron impact have been found to be formed with initial kinetic energy. Taking this energy into account, the electron impact data on methane are shown to be compatible with the spectroscopically acceptable value of 171 kcal/mole for the latent heat of sublimation of carbon in agreement with the value obtained by direct measurement. (auth)

4705

SZILARD-CHALMERS REACTIONS AND RELATED PROCESSES IN OXIDES. II. CHEMICAL STATE OF METASTABLE ^{204}Pb IN NEUTRON-IRRADIATED Pb_3O_4. A. H. W. Aten, Jr., P. A. Schenck, and H. Ohm. J. Inorg. Nuclear Chem. 5, 161-3(1958).

After irradiation of Pb_3O_4 with fast neutrons, the specific activity of Pb^{204m} was found to be the same in the plumbous and in the plumbic fraction. (auth)

4706

INFLUENCE OF FLUORINE SUBSTITUTION ON THE PROPERTIES OF METAL CHELATE COMPOUNDS. II. COPPER(II) CHELATES OF TETRADENTATE LIGANDS. A. E. Martell, R. Linn Belford, and M. Calvin (Univ. of California, Berkeley). J. Inorg. Nuclear Chem. 5, 170-81 (1958).

The ultra-violet, visible, and infra-red absorption spectra of four Schiff bases derived from β-diketones and their copper(II) chelates are described and discussed in relation to the structure of these molecules. Infra-red assignments are made where possible. The influence of fluorine substitution and ring size on the ultra-violet and visible spectra of the chelate compounds is discussed, and interrelaships between structure, stability, and absorption spectra are suggested. (auth)

4707

HOT LABORATORY OPERATION AND EQUIPMENT. VOLUME III. John R. Dunning and Bruce R. Prentice, eds. New York, Pergamon Press, 1957. 306p.

Papers presented at the Conference on Hot Laboratories and Equipment are given. This volume is broken down into six sections, including hot laboratory facilities, hot laboratory operations and administration, equipment for hot chemical and physical operations, equipment for hot me-

chanical and metallurgical operation, hot cell installations, and specialized hot operations. (W.L.H.)

Analytical Procedures

4708 ARDE(M)-17/57

Gt. Brit. Armament Research and Development Establishment, Fort Halstead, Kent, England.

THE DETERMINATION OF CARBON IN MOLYBDENUM AND ITS ALLOYS BY COMBUSTION IN OXYGEN. G. H. Bush, D. G. Higgs, and P. L. Rennles. Apr. 1957. 15p. (AD-134748).

This memorandum describes the work carried out to establish the conditions for the quantitative determination of carbon in molybdenum and seven of its alloys. It is shown that carbon can be determined, in all the cases considered, by combustion in oxygen at 800°C providing certain stipulated conditions are observed such as the period of combustion and the type of flux used. (auth)

4709 BM-RI-5378

Bureau of Mines.

X-RAY EMISSION SPECTROGRAPHIC ANALYSIS OF BASTNAESITE RARE EARTHS. Farrel W. Lytle, James I. Botsford, and Henry A. Heller. May 1957. 18p.

An x-ray emission spectrographic method of analysis is presented for determining rare-earth elements in fractions obtained from bastnaesite ore. The method includes determination of yttrium, thorium, lanthanum, and the rare-earth elements in various complex mixtures. The analysis technique is based upon comparing the samples with synthetic standards approximating the composition of the samples. Working curves are plotted on an absolute-intensity basis, with no correction for back-ground. Examples of working curves and the analyses of typical rare-earth concentrates are included. The selection of spectral lines for the various sample matrices is discussed. A special technique is used for samples in which rapid hydration and carbonation occurred. By analyzing synthetic samples of known composition, the accuracy of the method was determined. The average error of analysis was about 3 percent of the amount present in the range from 5 to 100 percent and about 7 percent in the 0.2- to 5-percent range. A maximum of about 40 samples per day may be analyzed for 7 elements each. (auth)

4710 NMI-1178

Nuclear Metals, Inc., Cambridge, Mass.

CONTRIBUTIONS TO THE CHEMICAL ANALYSIS OF COPPER IN ZIRCALOY, SILICON IN URANIUM–SILICON ALLOYS, AND NIOBIUM IN URANIUM–NIOBIUM ALLOYS. E. B. Read, P. R. Hicks, H. M. Lawler, E. Pollock, H. M. Read, and L. Zopatti. May 23, 1957. 22p. Contract AT(30-1)-1565. $0.25(OTS).

4711 AEC-tr-3130

POLAROGRAPHIC INVESTIGATION ELECTRODE REACTIONS FOR THE REDUCTION OF NIOBIUM AND TITANIUM FROM SULFURIC ACID SOLUTIONS. E. I. Krylov and B. S. Kolebatova. Translated from Zhur. Anal. Khim. 11, 144-8(1956). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 6556.

4712 AWRE-Trans-2

THE USE OF A SOLID DIPPING ELECTRODE IN THE ANALYSIS OF MELTS. Yu. S. Lyalikov and V. I. Karmazin. Translated by K. A. Mews from Zavodskaya Lab. 14, 144-8(1948). 12p.

An investigation was made of the application of a solid dipping electrode to the analysis of melts. The possibility of polarographic recording of melts, and of investigating the kinetics of decomposition of certain salts in melts was demonstrated. A reduction of certain waves was observed when certain ions were added to the melt, to give with the polarographed ion weakly dissociated deposits not soluble in the melt [$Ba_3(PO_4)_2$ in KNO_3]. Observation was made of the low solubility of certain salts and oxides in the principal base and the absence therein of ions of these salts in the case of saturation by them of the melt (TlCl, CuO, NiO in KNO_3). The possibility was established of the absence of dissociation to ions in the case of good solubility of the salts in the principal base ($CuSO_4$ and $NiSO_4$ in $K_2S_2O_7$). (auth)

4713 AWRE-Trans-4

A NEW METHOD FOR THE GRAVIMETRIC DETERMINATION OF FLUORINE (BINARY PHASE PRECIPITATION WITH TRIPHENYL–STANNICHLORIDE). R. Ballczo and H. Schiffner. Translated by L. J. Goodlet from Z. anal. Chem. 152, 3-18(1956). 18p.

The use of triphenyl-stannichloride for fluorine analysis for the direct determination of fluorine has been successfully demonstrated. The reagent is dissolved in chloroform instead of alcohol and only brought into intimate contact with the aqueous phase, containing the fluorine, by energetic stirring, when the fluoride precipitates (binary phase precipitation). It has by this means been possible not only to obtain the fluoride precipitate uncontaminated by the reagent and occluded salts, but also to obtain direct determination of the fluorine ion when in company with phosphate and borate ions or ions of iron, aluminum and zirconium, with sufficient accuracy. The relative error is only a few tenths of one percent. The method has been verified not only on test solutions but on samples of natural minerals. (auth)

4714

MEASUREMENT OF CONCENTRATIONS OF GASEOUS HALIDE TRACERS IN AIR BY POSITIVE ION EMISSION TECHNIQUES. Harvey A. Schultz (Argonne National Lab., Lemont, Ill.). Anal. Chem. 29, 1840-2(1957) Dec.

Dichlorodifluoromethane, Freon 12, is a promising tracer for atmospheric diffusion studies. It is an odorless, colorless gas, noncorrosive and nontoxic in the concentrations that are required. This gas can be measured in air in concentrations as low as 0.1 ppm by special techniques involving the use of a modified version of a halogen leak detector available commercially. The feasibility of this approach has been demonstrated by field tests illustrated herein and described more fully elsewhere. Current studies on the mechanism of operation are briefly outlined. (auth)

4715

EMISSION SPECTROMETRIC DETERMINATION OF OXYGEN IN TITANIUM AND TITANIUM ALLOYS. Velmer A. Fassel and William A. Gordon (Iowa State Coll., Ames). Anal. Chem. 30, 179-82(1958) Feb.

An emission spectrometric method for the determination of O_2 in Ti and Ti alloys is based on the direct current carbon arc excitation of a special electrode assembly which provides a molten Pt bath after the arc is initiated. The O_2 in the Ti sample is rapidly liberated from this bath into an Ar atmosphere which supports the arc discharge. The intensity ratio of the line pair is related to the O_2 content of the Ti sample. This procedure provides O_2 determinations with a precision comparable to the vacuum fusion or bromination-reduction techniques, but has the advantage of greatly reduced time requirements. (auth)

4716

ASCENDING CHROMATOGRAPHY OF POLYPHOSPHATES. George G. Berg (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 30, 213-16(1958) Feb.

Variables involved in the chromatographic analysis of

polyphosphates were surveyed in terms of their effect on R_f values. The variables included selection and concentration of components of solvent, composition of atmosphere, and condition of paper. An ascending method provided constancy of experimental conditions and permitted control of R_f values in terms of three properties of the solvent: choice of alcohol, amount of water, and pH. Isopropyl alcohol solvents were suitable for lower polymers only. Data on chromatographic identification of higher polymers by other solvents were obtained. (auth)

4717

APPARATUS FOR CONTINUOUS ELECTROCHROMATOGRAPHY. Harold H. Strain (Argonne National Lab., Lemont, Ill.). Anal. Chem. 30, 228-31(1958) Feb.

A simple, efficient, adaptable, and economical apparatus has been tested for continuous electrochromatographic separations. The stabilization medium for the flow of the background electrolytic solution and concomitant transverse electrical migration is a tapered sheet of soft, thick industrial filter paper. The support for the paper is a block of solidified polystyrene foam. Evaporation of the background electrolytic solution is prevented by the polystyrene foam support and by a loose curtain of polyethylene sheeting. This apparatus has been utilized for the continuous separation of various inorganic ions. (auth)

4718

DETERMINATION OF MICROGRAM QUANTITIES OF POTASSIUM BY X-RAY EMISSION SPECTROGRAPHY OF ION EXCHANGE MEMBRANES. P. D. Zemany, W. W. Welbon, and G. L. Gaines, Jr. (General Electric Research Lab., Schenectady, N. Y.). Anal. Chem. 30, 299-300(1958) Feb.

Potassium in the range 5 to 150 γ has been extracted from aqueous KCl solutions and from mica surfaces (where it is present as an exchangeable ion) by ion exchange membranes and determined by x-ray emission spectrography. A precision to about ±15% is attainable. (auth)

4719

ON THE ESTIMATION OF BERYLLIUM. PART II. A NEW RAPID GRAVIMETRIC METHOD FOR ITS ESTIMATION IN BERYL. Apurba Kumar Sen Gupta (University Coll. of Science, Calcutta). J. Indian Chem. Soc. 34, 725-7(1957) Oct.

A rapid gravimetric method for the determination of beryllium in beryl, based on a new extraction process using sodium tetrafluoborate as flux, is described. In the present method silica is driven away during fusion and beryllium is separated as tetrafluoberyllate from the sparingly soluble complex fluorides of iron and aluminum and then it is estimated as barium fluoberyllate. The method is compared to several other ones and advantages over others are discussed. (auth)

4720

PAPER CHROMATOGRAPHIC ANALYSIS OF IRRADIATED URANIUM IN A HYDROFLUORIC ACID MEDIUM. Carl E. Crouthamel (Argonne National Lab., Lemont, Ill.) and Alan J. Fudge (Atomic Energy Research Establishment, Harwell, Didcot, Berks.). J. Inorg. Nuclear Chem. 5, 240-4(1958).

Chromatographic papers have been found compatible with aqueous hydrofluoric acid developing solutions to approximately 60 per cent by weight of the acid. Hydrofluoric acid is also an important solution and complexing medium in the processing and analysis of certain irradiated targets and fissile materials. The aqueous-hydrofluoric acid and methyl ethyl ketone–hydrofluoric acid media have proved to be a very convenient and versatile system in the isolation of carrier free isotopes and in the analysis of irradiated materials. The complete or partial separations of twelve fission and and neutron capture isotopes of irradiated uranium are described. The identification of the isotopes has been made in most cases with a 256 channel scintillation spectrometer. (auth)

4721

ISOTOPE DILUTION, α-SPECTROMETER FOR U AND Th DETERMINATION. L. E. Howard (Bureau of Mineral Resources, Melbourne, Australia). Nucleonics 16, No. 2, 112, 114, 116, 118, 120-1(1958) Feb.

A method for the determination of U and Th in ores is proposed using a gridded ion chamber as a simple α spectrometer and an isotope-dilution technique to determine concentrations. The U and Th are extracted from the ore as iodate and oxalate, converted to the nitrate, and deposited as a very thin film on an Al disk. An α spectrum is then obtained, and the percentage of Th and/or U determined. The instruments are described. (J.S.R.)

Deuterium and Deuterium Compounds

4722

THE ROLE OF IONS IN THE RADIATION INDUCED EXCHANGE OF HYDROGEN AND DEUTERIUM. Sydney O. Thompson and Oliver A. Schaeffer (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 80, 553-8(1958) Feb. 5.

The α-particle induced reaction expressed by the overall equation $H_2 + D_2 \rightarrow HD$ has been investigated. It is found that the reaction has a large yield, 18,000 molecules are formed for each ion pair at 100 mm pressure of hydrogen. The reaction is extremely sensitive to trace impurities so that the yield for pure hydrogen is probably higher. The addition of trace amounts of xenon or krypton markedly inhibits the reaction, while moderate amounts of added argon, neon or helium have little effect on the reaction. In addition, it is found that none of the rare gases influence the thermal or photochemical induced exchange. The reaction is interpreted as due to an ion chain mechanism involving H_3^+ as the chain propagator. (auth)

4723

THE SYSTEM BORON TRIFLUORIDE–HEAVY WATER; HYDROXYTRIFLUOROBORIC ACID-d_2: $D[BF_3 \cdot OD]$. N. N. Greenwood (The Univ., Nottingham). J. Inorg. Nuclear Chem. 5, 224-8(1958).

The 1:1 addition compound between boron trifluoride and heavy water has been prepared and its properties compared with those of the normal monohydrate in order to obtain more information on the nature of the conduction process in these liquids. The compound melts at 11.0° and at this temperature the density is 1.8360 g ml^{-1}, the viscosity 12.21 cP, and the specific conductivity 1.835×10^{-2} Ω^{-1} cm^{-1}. (auth)

4724

SOME PROPERTIES OF BORON TRIFLUORIDE DIDEUTERATE, $D_3O[BF_3 \cdot OD]$; THE VISCOSITY OF ISOTOPIC PAIRS OF LIQUIDS, AND THE MECHANISM OF ELECTRICAL CONDUCTION IN MOLTEN COMPLEXES. N. N. Greenwood (The Univ., Nottingham). J. Inorg. Nuclear Chem. 5, 229-36(1958).

The melting point, density, viscosity, and electrical conductivity of the compound $BF_3.2D_2O$ are reported and compared with those of the dihydrate and the corresponding monohydrate and monodeuterate. The results are interpreted as suggesting that conduction occurs by ionic migration, rather than by a proton or deuteron switch mechanism. (auth)

4725

NEUTRON-DIFFRACTION OBSERVATIONS ON THE PALLADIUM–HYDROGEN AND PALLADIUM–DEUTERIUM SYSTEMS. J. E. Worsham, Jr., M. K. Wilkinson, and C. G. Shull (Oak Ridge National Lab., Tenn.). Phys. and Chem. of Solids 3, 303-10(1957).

Neutron-diffraction investigations on powdered samples have shown that both hydrogen and deuterium atoms in β-phase Pd–H and Pd–D are located in the octahedral positions of the palladium lattice. Results obtained for samples with low gas concentration are inconclusive in determining the atomic positions in the α-phase, since at room temperature only a small amount of gas enters this phase. Although the vibrational amplitudes of hydrogen and deuterium are similar to those observed in other compounds, the total neutron-scattering cross-section for hydrogen in this system is abnormally low, indicating that the protons are more nearly free than in the other hydrogen compounds. (auth)

Fluorine and Fluorine Compounds

4726 NACA-RM-E57E02

Lewis Flight Propulsion Lab., Cleveland.

REACTION OF FLUORINE WITH CARBON AS A MEANS OF FLUORINE DISPOSAL. Harold W. Schmidt. July 18, 1957. 18p.

Experiments have illustrated the feasibility of disposing of gaseous fluorine by reaction with charcoal. Fluorine and fluorine–oxygen and fluorine–nitrogen mixtures containing as little as 6.5 percent fluorine ignited spontaneously when impinged onto a bed of charcoal and reacted to produce chemically inert gaseous fluorocarbons. Fluorine and fluorine–oxygen mixtures were consumed at rates near 25 pounds per hour in an experimental portable reactor containing 6 cubic feet of charcoal; quantitative measurements of residual fluorine in the exhaust products ranged from 20.1 to 77.5 parts per million. (auth)

4727

THE DISSOCIATION PRESSURE OF SODIUM BIFLUORIDE — THE FREE ENERGY AND ENTHALPY CHANGE FOR THE REACTION $NaHF_2(s) \rightarrow NaF(s) + HF(g)$ FROM 157 TO 269°. Jack Fischer (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 6363-4(1957) Dec. 20.

The dissociation pressure of sodium bifluoride has been determined from 157 to 269° in a nickel and Monel system. Equations for the free energy change and the average enthalpy change from 157 to 269° were obtained for the reaction $NaHF_2(s) \rightarrow NaF(s) + HF(g)$. (auth)

Graphite

4728 NP-6538

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 4 for the Period October 1, 1957 to December 1, 1957. S. W. Bradstreet. Appendix I attached. 57p. Project No. G-033. Contract AF33(616)-5185.

The preliminary considerations which affect the processing and structure of multicrystalline carbon and graphite are concluded in this report with a brief discussion of the graphitizing process. Experimental preparation of molded specimens using calcined coke flour with a pitch binder has shown that a sound green specimen can be obtained with moderate pressure (12 to 15,000 psi) in a mold heated to the softening temperature of the pitch binder. Premixing of binder and coke flour by physical means alone (milling or hot blending) does not produce adequate distribution of binder and pressed specimens thus made exhibit variations in apparent green density of the order of ± three percent. When the binder is suspended in a suitable volatile solvent and mixed with coke flour, approximately three percent more of binder can be accommodated in the structure, the green density and carbonized density are improved, and deviation maxima can be reduced to ± one percent or less. Such low deviations are possible, however, only when de-solventation (accomplished by evacuating and heating both the mixing chamber and mold) is complete. Such specimens can attain apparent green densities of 1.74 g/cc and carbonized densities greater than 1.61 g/cc. In the binder investigation, the most promising materials appear to be bitumens and phenolics. Some materials (such as polyacrylonitrile) lose their bonding power during carbonization. Furfuryl alcohol, phenol-benzaldehyde, and melamine formaldehyde are being studied, and blends of the most promising formulations will be studied in the near future. As with pitch-bonded materials, these binders are most effective when a solventation-mixing technique is used to insure homogeneous distribution of the binder. The differential thermal analysis equipment is sufficiently sensitive to indicate certain exothermic and endothermic reactions with typical binder-coke mixes for phenolic binders. The current status is given of the construction of the high-temperature resistor tube furnace and test rigs, of the measurement of pertinent physical parameters on the "standard" coke, of devices for electrical measurements and porosity determinations of test coupons, and preliminary carbonizing experiments. (For preceding period see NP-6479.) (auth)

4729

THE ELECTRIC AND MAGNETIC PROPERTIES OF GRAPHITE. R. R. Haering and P. R. Wallace (McGill Univ., Montreal, Quebec, Can.). Phys. and Chem. of Solids 3, 253-74(1957).

The conduction electron magnetic susceptibility has been calculated taking into account band-to-band transitions. The calculation is an extension to three dimensions of a calculation by McClure. It is shown that agreement with experiment can only be retained if the inter-layer interaction is much weaker than was previously supposed. If the Fermi energy at zero temperature is ~0.06 ev and if the shift of the Fermi surface with temperature is taken into account, excellent agreement with experiment is obtained for all temperatures. The average value of the susceptibility at low temperatures and the average period of the de Haas-Van Alphen effect fluctuations independently determine the position of the Fermi level at low temperatures. The Haas-Van Alphen effect fluctuations turn out to be far too large, both in a two and in a three-dimensional calculation. In order to test the values of the various parameters, the ratio of the electrical conductivities, the Hall coefficient and the transverse magneto-resistance have also been calculated. (auth)

Laboratories and Equipment

4730

A COMPACT UNIT FOR POTENTIOMETRIC AND "DEAD-STOP END-POINT" TITRIMETRY. John T. Stock (Univ. of Connecticut, Storrs). Analyst 83, 56-7(1958) Jan.

A transistor-operated arrangement is described which is generally suitable for normal, differential, and "dead-stop end-point" titrimetry. High-resistance titration systems, such as those involving the glass electrode, are excluded,

since the titrimeter draws a current of a few microamperes from the system. Even with transistors selected at random, the zero is stable and the response is closely linear. An input e.m.f. of 100 mv produces meter readings of about 10 and 50 μa, respectively, at minimum and maximum sensitivity. (L.T.W.)

4731

A SUCTION-OPERATED DIFFERENTIAL ELECTRODE SYSTEM FOR POTENTIOMETRIC TITRATION. John T. Stock (Univ. of Connecticut, Storrs). Analyst 83, 57-9 (1958) Jan.

4732

AN ISOTOPE DISPENSER. A. Sivyer, E. W. Brain, A. Quinton, D. H. S. Boyd, and H. Besford (Queen Elizabeth Hospital, Birmingham). Brit. J. Radiol. 31, 55-6(1958) Jan.

Molecular Structure

4733

PURE QUADRUPOLE RESONANCE DETERMINATIONS OF MOLECULAR CHARGE DISTRIBUTIONS. I. SUBSTITUTED QUINONES, QUINOLINES, PYRIDINES, PYRIMIDINES, AND TRIAZINES. P. J. Bray, Saul Moskowitz, and H. O. Hooper (Brown Univ., Providence, R. I.) and R. G. Barnes and S. L. Segel (Iowa State Coll., Ames). J. Chem. Phys. 28, 99-102(1958) Jan.

The charge distributions in quinone and several heterocyclics containing nitrogen in the ring have been determined from the pure quadrupole resonance frequencies of attached halogens. Agreement with values from molecular orbital calculations is good in quinone and pyridine but poor in quinoline. Quantitative measurements are presented for the effect of ring nitrogens on the double bond character of carbon-halogen bonds. (auth)

Radiation Chemistry

4734

EQUIPMENT FOR HIGH LEVEL RADIOCHEMICAL PROCESSES. Nelson B. Garden and Elmer Nielsen (Univ. of California, Berkeley). Ann. Rev. Nuclear Sci. 7, 47-62(1957).

4735

CHEMICAL EFFECTS OF IONIZING RADIATIONS ON AQUEOUS INORGANIC SOLUTIONS. Edwin J. Hart (Argonne National Lab., Lemont, Ill.). J. Chem. Educ. 34, 586-93(1957) Dec.

The chemical changes induced in aqueous solutions under irradiation by α, β, γ, and x rays are described. The mechanism of free radical formation, the principles of chemical dosimetry, the determination of primary yields of molecular products and free radicals, and the kinetics of some chemical reactions in aqueous solutions are discussed. (L.T.W.)

4736

RADIATION-INDUCED NITRITE FORMATION FROM CONCENTRATED NITRATE SOLUTIONS. H. A. Mahlman and G. K. Schweitzer (Oak Ridge National Lab., Tenn. and Univ. of Tennessee, Knoxville). J. Inorg. Nuclear Chem. 5, 213-18(1958).

The γ-radiation-induced decomposition of nitrate solutions to form nitrite was investigated in the concentration range 0.001 to 5.0 M for a variety of nitrate salts. The nitrite formed was detected by the reduction of cerium(IV) ions present in solution during the irradiation. The enhanced cerium(III) yields were interpreted to be due to the formation of nitrite by direct action. The nitrite yield was found to be (1) independent of cation, (2) dependent upon the nitrate concentration, (3) dependent upon the total energy absorbed by the solution and (4) representable by the equation $G(NO_2^-)_{-da} = 1.22 \log [NO_3^-] + 1.70$, where $G(NO_2^-)_{-da}$ is the direct action formation of nitrite and $[NO_3^-]$ is the nitrate molarity. (auth)

4737

RETENTION AND RADIOLYSIS OF SOME CHROMATES. G. Harbottle and A. G. Maddock (Brookhaven National Lab., Upton, N. Y.). J. Inorg. Nuclear Chem. 5, 249-50(1958).

To discover some of the factors determining retention of activity after neutron irradiation of solid substances, a comparison of the retention and radiation decomposition of some chromates was made. (W.L.H.)

4738

THE OXIDATION OF FERROUS SULFATE WITH 200-Kv X-RAYS, COBALT-60 γ-RAYS AND 22-Mevp X-RAYS. W. K. Sinclair and R. J. Shalek (M. D. Anderson Hospital and Tumor Inst., Houston, Texas). Radiology 70, 92-3 (1958) Jan.

Radiation Effects

4739 HW-53717

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

IRRADIATION OF ORGANIC REACTOR COOLANTS IN DYNAMIC SYSTEMS. D. R. de Halas. Nov.25, 1957. 42p. Contract W-31-109-Eng-52. $1.25(OTS).

A rate law has been derived for the combination of radiolytic and pyrolytic damage to organic coolants. The equation is $dC/d\epsilon = -[C(k_1 + k_2) - k_2]$, C is the concentration of pure organic in the coolant. ϵ is the exposure. k_1 and k_2 are rate constants which include a term for the influx to total volume ratio of the loop. The law is based on observations of pure radiolytic damage in the test loop, and the behavior of the radiolytic tars towards heat. (auth)

4740 WADC-TR-57-186 (Rpt: UNCLASSIFIED)

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

THE EFFECTS OF NUCLEAR RADIATION ON MILITARY SPECIFICATION PAINTS. Period covered: September 1955 to August 1956. Lloyd A. Horrocks. Mar. 15, 1957. 29p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ORGANIC PROTECTIVE COATINGS. (AD-142143).

This report is an evaluation of the effects of gamma radiation and heat on several available types of specification and non-specification paints. Reflectance, adhesion, abrasion, humidity, and film condition data are presented on the effects of gamma radiation and heat on silicone-alkyd, fluorocarbon, alkyd, nitrocellulose, phenolic, and epoxy resin-based paints. Silicone-alkyd, alkyd, and phenolic resin-based paints appear to be satisfactory for use after exposure to 1×10^9 roentgens. (auth)

4741 AEC-tr-3116

CHANGE IN THE ELECTROCHEMICAL ACTIVITY OF ZIRCONIUM UNDER THE EFFECT OF RADIATION. I. L. Rozenfeld and E. K. Oshe. Translated from Doklady Akad. Nauk S.S.S.R. 114, 143-5(1957). 6p.

Under irradiation of the Zr–Al and Zr–Fe elements in a moving electrolyte (3% NaCl) by a high-energy electron current (0.8 Mev) with an intensity of 15 Na/cm^2 a sharp increase in the current of the pairs was detected. The current increased directly following irradiation and exceeded the current of the pairs before irradiation by 15 to 20 fold. Later during the entire experiment (1 hour) the current

changed relatively little. With the end of irradiation the current dropped sharply, almost to the original value. Experiments in which only the anode or cathode underwent irradiation showed that the observed effect was noticed only upon irradiation of the cathode (Zr). Upon irradiation of the anode (Al or Fe) the effect is not observed. The results of these experiments are given. For a comparison the curves of the dependence of the current strength of the element on time in the absence of irradiation at room temperature are presented, and also at a temperature which appears at the surface of the division of the metals, the electrolyte due to absorption of the irradiation energy. (auth)

4742

EFFECTS OF NUCLEAR IRRADIATION UPON THE DECOMPOSITION OF LEAD STYPHNATE MONOHYDRATE. Ted B. Flanagan (Picatinny Arsenal, Dover, N. J.). Nature 181, 42-3(1958) Jan. 4.

Rare Earths and Rare-earth Compounds

4743 NP-6531

University of Southern California, Los Angeles.
STUDIES OF THE RARE-EARTH HYDRIDES. Technical Report XI. James C. Warf, Jerry Donohue, and Kenneth Hardcastle. Oct. 1957. 8p. Project No. NR 052-390. Contract NOnr-22815.

Conductivity measurements were carried out on La, Ce, Pr, and Nd hydrides. Dispersions of Yb, Ca, and La in Hg are described. Nuclear magnetic resonance investigation of $LaH_{2.8}$ and $CeH_{2.7}$ is presented. (W.L.H.)

4744 AWRE-Trans-3

THE COLORIMETRIC REACTIONS OF THE RARE EARTH ELEMENTS. V. I. Kuznetsov. Translated by L. J. Goodlet from Zhur. Anal. Khim. 7, 226-32(1952). 14p.

The arsenazo reagent (benzene-2-arsonic- <1-azo-2> 1.8-diaxynaphthalene-3.6-disulphonic acids-sodium salt) dissolving in water with a pink coloration forms with rare earth elements in neutral solution a reddish-violet color reaction, enabling identification of these elements in dilutions down to 1 in 3 million. The identification of rare earth elements in pure solutions is described, and methods given for eliminating interference by Fe and other reacting elements. A method is described for the determination of rare earth elements in minerals, in which a part of the reacting elements is separated by coprecipitation with metastannic acid precipitating in the hydrolysis of $SnCl_4$, while the reactive elements remaining in the solution are masked with ammonium salicylate. The synthesis of the reagent is described. (auth)

4745

ANALYSIS OF RARE EARTH MIXTURES BY A RECORDING SPECTROPHOTOMETER. D. C. Stewart and Dorothy Kato (Argonne National Lab., Lemont, Ill.). Anal. Chem. 30, 164-72(1958) Feb.

Multiple tracing light absorption curves of the rare earth chlorides in solution (except lanthanum, promethium, and lutecium), taken with the Beckman DK recording spectrophotometer, permit direct evaluation of interferences. Index peaks for analytical purposes have been recommended for each element, and expressions have been derived to correct absorbance readings for interferences from other rare earths. Certain absorption peaks in the near-infrared portion of the spectrum may be used for rare earth determinations, and the 219-mμ peak in the ultraviolet for determining terbium. The suggested methods have been found satisfactory for rare earth mixtures of known composition, including one containing 11 components. (auth)

4746

ABSORPTION SPECTRA OF TERBIUM PERCHLORATE AND TERBIUM CHLORIDE SOLUTIONS. E. I. Onstott and C. J. Brown (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 30, 172-4(1958) Feb.

The spectra of terbium perchlorate and terbium chloride solutions have been recorded in the range of 200 to 1200 mμ with the Cary recording spectrophotometer. An intense absorption at 219.8 mμ follows Beer's law and is usable for accurate determination of terbium at low concentrations. The molar extinction coefficient for perchlorate solutions was calculated to be 320. There are a number of minor absorptions in the range of 240 to 380 mμ, and a minor absorption at 487 mμ, but no significant absorptions at other wave lengths up to 1200 mμ. Beer's law is followed for most of the absorptions; notable exceptions are the absorptions at 263 mμ and at 265 mμ. (auth)

4747

X-RAY FLUORESCENT SPECTROMETRIC DETERMINATION OF YTTRIUM IN RARE EARTH MIXTURES. Robert H. Heidel and Velmer A. Fassel (Iowa State Coll., Ames). Anal. Chem. 30, 176-9(1958) Feb.

The great similarity in the chemical properties of Y and the rare earth group of elements prevents use of classical chemical methods for the separation and determination of Y. An x-ray fluorescent spectrometric method for determining Y in mixtures of rare earths and Th is described. For the determination of Y in ores, a preliminary rare earth group separation is required. Samples are analyzed in solution form, with Sr added as an internal standard. At 50% Y_2O_3 content, a coefficient of variation of 0.74 is obtained for the intensity ratio. Analytical results on a series of samples agree on the average within ± 2.8% of the amount found by optical emission spectrographic procedures. (auth)

4748

THE HYDROGEN PEROXIDE-INDUCED Ce*(III)–Ce(IV) EXCHANGE SYSTEM. Paul B. Sigler and B. J. Masters (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 6353-7(1957) Dec. 20.

The technique of isotopic exchange in non-stable systems has been applied to study the kinetics of the reaction between Ce(IV) and H_2O_2 in 0.8 N H_2SO_4 solution. In addition to the bimolecular electron exchange reaction between Ce*(III) and Ce(IV), an induced exchange reaction is found to occur at a rate proportional to the concentration ratio [Ce(III)]/[Ce(IV)]. The results are consistent with the mechanisms $H_2O_2 + Ce(IV) \overset{k_1}{\rightleftharpoons} HO_2 + Ce(III) + H^+$ and $HO_2 + Ce(IV) \xrightarrow{k_2 k_3} Ce(III) + O_2 + H^+$. (auth)

4749

LANTHANUM RHODIUM AND LANTHANUM COBALT OXIDES. Aaron Wold, Benjamin Post, and Ephraim Banks (Massachusetts Inst. of Tech., Lexington. Lincoln Lab. and Polytechnic Inst. of Brooklyn). J. Am. Chem. Soc. 79, 6365-6(1957) Dec. 20.

$LaRhO_3$ containing rhodium in the trivalent state has been prepared and studied by x-ray diffraction powder methods. Calculations based on the x-ray data show that $LaRhO_3$ has a distorted perovskite structure. It is orthorhombic, its space group is D_{2h} (16) Pbnm and there are four formula weights per unit cell. The lattice constants are a = 5.524 A., b = 5.679 A., c = 7.900 A. $LaCoO_3$ belongs to space group D_{3d} (5) $\bar{3}$m with two formula weights per unit cell. The dimensions of the rhombohedral pseudocell are a = 7.64 A., α = 90°42′. The dimensions of the primitive rhombohedral pseudo cell are a_p = 5.436 A., α_p = 60°48′. The hexagonal form of this cell has the following dimensions: a = 5.424 A., c = 13.068 A. (auth)

4750

ABSORPTION SPECTRA OF RARE EARTHS IN GLASSES. R. C. Vickery and R. Sedlacek (Horizons, Inc., Cleveland, Ohio). Nature 181, 39-40(1958) Jan. 4.

Separation Procedures

4751 AECU-3620

Bureau of Mines. Intermountain Experiment Station, Salt Lake City.

RESEARCH AND PROCESS INVESTIGATIONS ON LAKEVIEW ORE, LAKE COUNTY, OREG. I. L. Nichols, K. E. Tame, J. R. Ross, and J. B. Rosenbaum. Dec. 1957. 30p. (RR-50.1). $6.30(ph OTS); $3.00(mf OTS).

Ore from the Lakeview Mining Co. was tested in the pilot plant and laboratory. The testing included grinding, leaching, countercurrent decantation, solvent extraction, precipitation, flotation, and molybdenum recovery. (W.L.H.)

4752 ANL-4709(Del.)

Argonne National Lab., Lemont, Ill.

THE ARGONNE FLUORIDE VOLATILITY PROCESS, STATUS AS OF DECEMBER 31, 1951. H. H. Hyman and J. J. Katz. Feb. 10, 1952. Decl. with deletions Feb. 13, 1957. 207p. Contract W-31-109-eng-38. $30.30(ph OTS); $8.70(mf OTS).

The development of a chemically feasible fluoride volatility process is summarized. The Argonne fluoride volatility process is described, and flowsheets are given. Experimental programs involved in demonstrating the separation of UF_6 and fission product fluorides and separation of U and Pu are summarized. Discussions are given of waste disposal and by-product recovery problems associated with this type of process, economic aspects of the process, and analytical problems. A bibliography of 238 references is included. (W.L.H.)

4753 CF-54-4-39(Del.)

Oak Ridge National Lab., Tenn.

RECOVERY OF URANIUM FROM THE SPENT STAINLESS STEEL FUEL ELEMENTS OF THE PACKAGE REACTOR. J. E. Savolainen. Apr. 6, 1954. Decl. with deletions May 7, 1957. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A solvent extraction process for recovering uranium from spent stainless-steel clad Package Reactor fuel elements is proposed, and the results of limited laboratory work establishing its feasibility reported. The process differs from those previously developed for stainless-steel clad fuel elements principally in the method used to bring the fuel into solution prior to solvent extraction recovery and purification. This process is based on the original concept of destroying the passivity of the stainless steel by the introduction of carbon into the metal to form chromium carbide. (auth)

4754 KAPL-1809

Knolls Atomic Power Lab., Schenectady, N. Y.

BELGIAN SYMPOSIUM ON CHEMICAL PROCESSING. II. SESSION: AQUEOUS REPROCESSING—APPLICATION OF MIXER-SETTLERS TO THE PUREX PROCESS. J. K. Davidson, A. C. Schafer, Jr., and W. O. Haas, Jr. May 8, 1957. 26p. Contract W-31-109-Eng-52. $1.00(OTS).

Multistage mixer-settler equipment provides a means of obtaining high efficiency mass transfer with flexibility. As a general rule the efficiency of mixer-settlers is between 75 and 100%. Greater process flexibility is achieved since the degree of mixing is an independent variable. The fact that each stage is a separate entity, essentially equivalent to a theoretical stage, facilitates stage sampling and design scale-up. The pump-mix mixer-settler is discussed in some detail. Experience with pilot-plant pump-mix units in Purex system studies is cited to show that this equipment is reliable, flexible in operation, and capable of high efficiency. (auth)

4755 KAPL-M-ONS-2(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

PROPOSAL OF A NEW METHOD FOR THE SEPARATION OF HYDROGEN AND DEUTERIUM BY CHEMICAL EXCHANGE BETWEEN SIMPLE HYDROGEN COMPOUNDS AND PALLADIUM HYDRIDE AND PALLADIUM DEUTERIDE. Oliver N. Salmon. Feb. 9, 1953. Decl. with deletions Feb. 25, 1957. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The application of H isotope exchange between Pd hydride and deuteride solid solution and water to a dual temperature process for the production of D_2O is discussed. Theoretical separation factors were estimated for the H_2O-Pd_2D exchange and NH_3 – Pd_2D exchange and compared with those of some of the previously studied exchange reactions which have been considered favorable for dual temperature processes. An equation for calculating the separation factor as a function of composition for the H_2O – Pd hydride and deuteride are derived here to illustrate the theory involved. (M.H.R.)

4756 NP-6553

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

ALKALINE CARBONATE LEACHING OF URANIUM ORES. Review of Test Work Completed to Date. F. T. Rabbitts. Nov. 13, 1950. 38p. (TR-67/50).

Preliminary investigations have shown that samples of U ore can be leached with Na_2CO_3 solution containing an oxidizing agent and that an extraction of well over 90% can be obtained. The extraction can be conducted either under pressure at 200°C or at normal pressure at 100°C. Both procedures are being investigated. (auth)

4757 ORNL-1859

Oak Ridge National Lab., Tenn.

THE USE OF AMINES AS EXTRACTANTS FOR THORIUM (AND URANIUM) FROM SULFURIC ACID DIGESTS OF MONAZITE SANDS. D. J. Crouse and J. O. Denis. Feb. 1, 1955. Decl. Feb. 8, 1957. 33p. Contract W-7405-eng-26. $0.35(OTS).

The use of long-chain amines as extractants for Th and U from liquors obtained by digestion of monazite sand with H_2SO_4 was studied. Coefficients for extraction of Th were measured for several amines of representative types, and certain of these were also examined with respect to their extractive power for U, rare earths, and PO_4^{3-}. In addition, a brief evaluation was made of several methods for recovering Th from the extract. (auth)

4758 RMO-4012

Columbia Univ., New York. Mineral Beneficiation Lab.

RECOVERY OF URANIUM FROM CHATTANOOGA SHALE. Quarterly Progress Report. June 1957. 65p. Contract AT(49-1)-621. $9.30(ph OTS); $3.60(mf OTS).

The investigation of countercurrent leaching by the pseudo continuous method detailed in earlier reports has been concluded with a test run using leach liquor derived from O_2, pressure leaching as the acid source. Uranium extraction was substantially less than had been achieved using pure acid. The comprehensive study of the chemistry of O_2, pressure leaching has continued, and the results are presented in considerable detail. Construction of a continuous process demonstration unit, including leaching, countercurrent washing and U recovery by NBA solvent extraction, is in an advanced state. Equilibrium extrac-

tion curves are given for NBA and for amine S-24, and some rate curves are shown for synergistic phosphate combinations as extractants. (auth)

4759 UCRL-8029

California. Univ., Berkeley. Radiation Lab. LONGITUDINAL DISPERSION IN SOLVENT-EXTRACTION COLUMNS: PECLET NUMBERS FOR ORDERED AND RANDOM PACKINGS. Gabriel L. Jacques and Theodore Vermuelen. Nov. 1957. 152p. Contract W-7405-eng-48. $24.30(ph OTS); $7.50(mf OTS).

Dispersion phenomena in packed beds in both axial and radial directions were studied to provide basic data for extraction-tower design Nine different beds were used, involving regular and random arrangements of spheres, and random arrangements of Raschig rings and Intalox saddles. For one-phase flow a wide range of Reynolds numbers was used (5 to 2000), covering regions of laminar, transition, and turbulent flow. For the axial Peclet number, different constant values were found in the turbulent range and in the laminar range. The existence of a fairly sharp transition region was observed. Radial-dispersion results showed similar behavior. The axial Peclet number was found to vary inversely with bed porosity, while the radial Peclet number was almost proportional to porosity. For two-phase flow, measurements were made up to the flooding point, which occurred at Reynolds numbers near 100. The axial Peclet number for both continuous and discontinuous phases is a function of the Reynolds numbers for the two individual phases. For each phase, the laminar value of the axial Peclet number obotained for one-phase flow is an upper limit. Values as low as one-fifth of this limiting value were found at relatively large flow rates of the second phase. The radial Peclet number was measured only for the continuous phase of two-phase systems; it was found to decrease in the same direction, but by a smaller percentage. (auth)

4760

RECENT ADVANCES IN THE PREPARATION AND USES OF ION-EXCHANGE RESINS. D. K. Hale (Chemical Research Lab., Teddington, Middlesex). Analyst 83, 3-9 (1958) Jan.

4761

THE DETERMINATION OF URANIUM BY SOLVENT EXTRACTION. PART I. THE SEPARATION OF URANIUM-233 FROM IRRADIATED THORIUM AS THE DIETHYLDITHIOCARBAMATE COMPLEX. W. H. Hardwick and M. Moreton-Smith (A.E.R.E., Harwell, nr. Didcot, Berks). Analyst 83, 9-13(1958) Jan.

The analytical separation of trace amounts of uranium by solvent extraction has been investigated, with particular reference to the determination of U^{233} in irradiated thorium. The methods that have been evolved are applicable to the separation of uranium from many other elements under appropriate conditions. The use of isobutyl methyl ketone in conjunction with sodium diethyldithiocarbamate is described. (auth)

4762

THE DETERMINATION OF URANIUM BY SOLVENT EXTRACTION. PART II. THE SEPARATION OF URANIUM-233 FROM IRRADIATED THORIUM AS THE OXINE COMPLEX IN THE PRESENCE OF ETHYLENEDIAMINE-TETRA-ACETIC ACID. R. F. Clayton, W. H. Hardwick, M. Moreton-Smith, and R. Todd (A.E.R.E., Harwell, nr. Didcot, Berks). Analyst 83, 13-23(1958) Jan.

The development of solvent-extraction methods for determining trace amounts of U^{233} in irradiated thorium is described. Thorium and its alpha-emitting daughters are complexed with EDTA, and, when U^{233} is extracted as its diethyldithiocarbamate complex, only Bi^{212} accompanies it. This is immaterial for colorimetric or fluorimetric finishes, but, for determination of the U^{233} by alpha counting, the Bi^{212} must first be allowed to decay. If, however, the U^{233} is extracted as its 8-hydroxyquinoline complex, no alpha emitter accompanies it and concentrations of U^{233} ranging from 100 μg per ml down to 0.01 μg per ml in 0.7 M thorium solution have been determined in this way. (auth)

4763

RADIOCHEMICAL SEPARATIONS BY ION EXCHANGE. Kurt A. Kraus and Frederick Nelson (Oak Ridge National Lab., Tenn.). Ann. Rev. Nuclear Sci. 7, 31-46(1957).

4764

ATOMIC-AGE METAL EXTRACTION. L. W. Coffer (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. 65, No. 2, 107-22(1958) Jan. 27.

Processes for the separation of U, Zr, Hf, Co, Ni, Mn, Fe, V, and Ti from their ores are discussed from the standpoint of the chemistry and metallurgy involved. (W.L.H.)

4765

SEPARATION OF THORIUM AND RARE-EARTH ELEMENTS IN NITRIC ACID MEDIA BY ANION EXCHANGE. J. Danon. J. Inorg. Nuclear Chem. 5, 237-9(1958).

The distribution coefficients of thorium and praseodymium between Dowex-1 and aqueous nitric acid have been determined. Separations between thorium and the rare-earth elements are described. (auth)

4766

SEPARATION OF NIOBIUM FROM ZIRCONIUM BY A CATION EXCHANGER. Hirotoshi Sano and Reiko Shiomi (Univ. of Tokyo, Japan). J. Inorg. Nuclear Chem. 5, 251-2(1958).

4767

NH_4F—VERSATILE REAGENT FOR ZIRCONIUM FUELS. A. T. McCord and D. R. Spink (Carborundum Metals Company, Inc., Akron, N. Y.). Nucleonics 16, No. 2, 94, 96, 98, 100, 102, 104(1958) Feb.

The dissolution and treatment of Zr and its alloys and its separation from U and fission products can be effected by the use of NH_4F. Used in the acidic or neutral state, NH_4F is easier to handle and more economical than currently used reagents. An electrolytic process using NH_4F has been found which improves the corrosion properties of Zr and Zircalloy. (J.S.R.)

Syntheses

4768 AEC-tr-2911

ON THIAZOLE SYSTEM AMINE-N-OXIDES. Eiji Ochiai and Eisaku Hayashi. Translated from J. Pharm. Soc. Japan 67, 34-5(1947). 6p.

The synthesis of amine-N-oxides from 4-methylthiazole and 2,4-dimethylthiazole is described. (W.L.H.)

Tracer Applications

4769

TRACER APPLICATIONS FOR THE STUDY OF ORGANIC REACTIONS. John G. Burr, Jr. New York, Interscience Publishers, Inc., 1957. 299p.

This volume presents a survey of tracer applications in organic chemistry and some generalizations of the principles of isotopic tracer use. (W.L.H.)

Transuranic Elements and Compounds

4770 UCRL-4937

California. Univ., Livermore. Radiation Lab.

SPHERICAL AND CYLINDRICAL PLUTONIUM CRITICAL MASSES. Fred A. Kloverstrom. Sept. 1957. 18p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Experiments to determine critical masses of δ-phase plutonium cylinders of three diameters with thin metallic reflectors are reported. Critical reflector thickness measurements were made with two spherical Pu cores; the cylindrical and spherical data are combined to yield shape factors for the spheres for U^{233} and Be reflection. (auth)

4771

THE PREPARATION OF PuP_2O_7 AND $PuPO_4$. Carl W. Bjorklund (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 6347-50(1957) Dec. 20.

Methods for the preparation of two new plutonium phosphates, $PuPO_4$ and PuP_2O_7, are described. Monoclinic $PuPO_4$ was prepared by the precipitation and high temperature dehydration of hexagonal $PuPO_4 \cdot [0.5H_2O(?)]$ and by the decomposition of a crystalline plutonium(IV) oxalatophosphate which contained a P/Pu atomic ratio of 1/1. Plutonium(IV) oxalatophosphates of variable composition with P/Pu ratios ranging from 1/1 to 2/1 were prepared. Cubic PuP_2O_7 was obtained by the decomposition of the plutonium(IV) oxalatophosphate with a P/Pu ratio of 2/1 and by the decomposition of phosphorus-deficient oxalatophosphates mixed with sufficient solid $NH_4H_2PO_4$ to restore the over-all P/Pu ratio to 2/1. Both compounds, $PuPO_4$ and PuP_2O_7, were characterized by x-ray, microscopic, and chemical analyses. (auth)

4772

THE KINETICS OF THE DISPROPORTIONATION OF PLUTONIUM(V). Sherman W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 6350-3 (1957) Dec. 20.

A study has been made of the kinetics of the disproportionation of plutonium(V) in perchlorate solutions of unit ionic strength in which the PuO_2^+ was prepared by the reduction of the plutonyl ion with iodide ion. With this method of preparation, the disproportionation of plutonium(V) was studied in the absence of significant quantities of plutonium(III) and (IV) in the initial phases of the experiments. The rate of disproportionation of plutonium(V) has been found to be directly proportional to the first power of the hydrogen ion concentration, which suggests that the slow step is probably $PuO_2^+ + Pu(O)OH^{++} \rightarrow PuO_2^{++} + Pu(O)OH^+$. An activation energy of 19.6 kcal. has been computed from the temperature dependence of the specific reaction rate constants for the slow step of the disproportionation reaction. The disproportionation of plutonium(V) has also been studied in deuterium oxide to note the influence of a change in solvent upon the reaction rates. It appears from the kinetic results obtained that no evidence has been found which would support the hydrogen atom transfer mechanism in the plutonium(V) disproportionation reaction. Plutonium(V) also has been prepared from the plutonyl ion by the spontaneous α-reduction process. The kinetic data appear to be adequately described by a consideration of previously determined rate and equilibrium constants and the rate constant for the Pu(V) – Pu(V) reaction which was obtained from the experiments in which the plutonyl ion was reduced with iodide. (auth)

4773

THE MICROSCALE PREPARATION AND MICROMETALLURGY OF PLUTONIUM METAL. S. Fried, E. F. Westrum, Jr., H. L. Baumbach, and P. L. Kirk (Argonne National Lab., Lemont, Ill.). J. Inorg. Nuclear Chem. 5, 182-9(1958).

An historical survey of the methods used at the Metallurgical Laboratory in the first preparations of plutonium metal are given. The techniques and conditions necessary for the preparation of the metal are described in detail, and the effects of the several variables temperature, reductant, crucible material, etc. are discussed. These methods are capable of and have been extended to the preparation of small amounts of the highly radioactive heavy elements. The method of determining the density of microgram amounts of plutonium metal is described and the experimentally determined densities of plutonium metal are given. (auth)

4774

PLUTONIUM DIOXIDE AS NUCLEAR FUEL. M. Taube. Nucleonika 2, 465-78(1957). (In Polish)

Properties and limitations of metallic Pu as nuclear fuel are discussed. Comparisons were made of PuO_2 and U, and results indicate the possibility of wider application of PuO_2 as nuclear fuel in many different power reactors. (tr-auth)

Tritium and Tritium Compounds

4775

THE REACTIONS OF TRITIUM TRAPPED IN INORGANIC CRYSTALS. W. J. Hoff, Jr. and F. S. Rowland (Princeton Univ., N. J., and Univ. of Kansas, Lawrence). J. Inorg. Nuclear Chem. 5, 164-9(1958).

Tritium produced and trapped in neutron irradiated LiCl has been released by solution under a variety of conditions. With acetone as the solvent, a variable fraction of the activity reaches stable chemical combination in tritium-labelled acetone. A large amount of activity is found as labile hydrogen after solution in acetone, ethyl alcohol, and acetic acid. The acetone results indicate the presence of a reactive species of hydrogen in the irradiated LiCl. (auth)

Uranium and Uranium Compounds

4776 AERE-C/R-2320

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CO-ORDINATION CHEMISTRY OF URANIUM: A CRITICAL REVIEW. Alan E. Comyns. Aug. 1957. 16p.

Co-ordination compounds of uranium with oxygen, nitrogen, and phosphorus donors are reviewed and their possible molecular structures discussed. The co-ordination number of the uranium atoms in these compounds probably always exceeds six, but in no case has the structure been definitely established. (auth)

4777 CF-54-6-208

Oak Ridge National Lab., Tenn.

EXCER: MOVING-BED STUDY FOR UF_4 PRODUCTION. Program Statement. J. E. Moore. June 3, 1954. Decl. Apr. 3, 1957. 10p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

4778 TID-5222

California. Univ., Berkeley. Radiation Lab. and Argonne National Lab., Lemont, Ill.

PRODUCTION AND SEPARATION OF U^{233}. Survey. Glenn T. Seaborg and Leonard I. Katzin, eds. 1951. Decl. with deletions Jan. 11, 1957. 236p. $1.25(OTS).

This is a deleted version of NNES-IV-17A.

Some historical aspects, the nuclear reactions involved

in production, and the nuclear properties, especially the radioactive properties, of U^{233} are discussed. A short summary of the factors which are basic to the large-scale production of the isotope is included. The role of U^{233} in atomic power development is dealt with in a general way. Chemical methods for isolation of U^{233} and chemical aspects of its production on a large scale are surveyed. A discussion of the special chemical-purification problem is presented. The chemical properties of Pa, the chemical and metallurgical properties of Th, and information important for U^{233} development are surveyed. The nuclear properties of the isotopes of Th, Pa, and U are summarized. (M.H.R.)

4779

SELF-DIFFUSION OF OXYGEN IN URANIUM DIOXIDE. A. B. Auskern and J. Belle (Westinghouse Electric Corp., Pittsburgh). J. Chem. Phys. 28, 171-2(1958) Jan.

4780

THE OCCURRENCE OF MOLYBDENUM-99 IN NATURAL AND IN DEPLETED URANIUM SALTS AND THE SPONTANEOUS FISSION HALF-LIFE OF URANIUM-238. P. L. Parker and P. K. Kuroda (Univ. of Arkansas, Fayetteville). J. Inorg. Nuclear Chem. 5, 153-8(1958).

Measurements of the Mo^{99}/U^{238} equilibrium ratios in aqueous solutions of nonirradiated uranium salts gave the following results: $(4.4 \pm 0.4) \times 10^{-4}$ and $(4.4 \pm 0.3) \times 10^{-4}$ disintegrations per second of Mo^{99} per gramme of U^{238} in natural uranium and in depleted uranium, respectively. A value of $(8.0 \pm 0.5) \times 10^{15}$ years, which agrees with Segrè's value, is obtained from the above data for the spontaneous fission half life of U^{238}, if one assumes that the yield of Mo^{99} is 6.4 per cent and the spontaneous fission of U^{238} is the only source of Mo^{99}. (auth)

4781

SZILARD-CHALMERS REACTIONS AND RELATED PROCESSES IN OXIDES. I. CHEMICAL STATE OF ^{239}U IN NEUTRON-IRRADIATED U_3O_8. A. H. W. Aten, Jr., M. J. Beers, and D. C. de Groot. J. Inorg. Nuclear Chem. 5, 159-60(1958).

Tetravalent and hexavalent uranium isolated from U_3O_8 irradiated with slow neutrons were found to have the same specific activity of U^{239}. (auth)

4782

NEW APPROACH TO ELECTROLYTIC U. L. W. Niedrach, B. E. Dearing, and A. C. Schafer (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 16, No. 1, 64-5 (1958) Jan.

A process analogous to the Hall process for Al, whereby UO_2 is electroreduced directly to metal, is amenable to continuous operation when run at temperatures above the melting point of U. A production-scale cell for such a process is described. (L.M.T.)

Waste Disposal

4783 NP-6541

MSA Research Corp., Callery, Penna.

SIMULATION OF CONTAINER VENTING UNDER SEA WATER. Technical Report No. 59. M. J. McGoff and S. J. Rodgers. Dec. 31, 1957. 22p. Contract NObs-65426.

The underwater release of radioactive contaminants from a reactor compartment was simulated by ejecting contaminated steam and air from an open end 2 in. pipe submerged in 10 ft of synthetic sea water. Two runs were conducted with Na^{24} and Rb^{86} representing a water soluble contaminant, Y^{90} representing a water insoluble contaminant and I^{131} representing a water soluble or a volatile contaminant, depending upon the oxidation state of the I. These runs indicated the efficiency of sea water in removing airborne and steamborne radioactive contaminants. The 10 ft column of sea water removed about 95% of the total contaminant activity escaping from the vapor container. The removal distribution among the components was approximately 100% of Rb^{86}, 96% of Y^{90} and 86% of I^{131}, thus indicating least removal of the volatile contaminant. (auth)

4784

PROBLEMS OF RADIOACTIVE WASTE IN MODERN TECHNIQUE. W. J. Spicyn (Inst. of Nuclear Research, Warsaw). Nucleonika 2, 451-4(1957). (In Polish)

Methods for separation and recovery of Cs^{137} and Sr^{90} from mixtures of fission products and the absorptive properties of soil as a medium for waste disposal are discussed. (tr-auth)

ENGINEERING

4785 HW-35489

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FEASIBILITY REPORT—100-DR WAPD TEST LOOP. Mar. 15, 1955. 26p. Contract [W-31-109-eng-52]. $7.80(ph OTS); $3.30(mf OTS).

The purpose of this report is to present a HAPO proposal for the design and construction of a high-temperature, high-pressure light water recirculation test facility for the Westinghouse Electric Corporation, Atomic Power Division. This report does not attempt to justify the feasibility of site location nor does it attempt to elaborate on such technical considerations as permissible test specimen heat generation and enrichment requirements which have been covered in an earlier document. Instead, detail information is developed on the proposed design with major emphasis on detail descriptions of the proposed loop and auxiliaries, design and construction scheduling and costs, and operating costs. (auth)

4786 HW-53404

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HIGH TEMPERATURE, HIGH PRESSURE NOZZLE-TO-TUBE CONNECTIONS FOR THE 1706 KER FACILITY. D. R. Doman. Nov. 1, 1957. 19p. Contract W-31-109-Eng-52. $0.75(OTS).

Out-of-reactor tests were made on three types of reactor nozzle to Zircaloy-2 process tube connections for use in the 1706 KER in-reactor high-temperature pressurized water test facilities. Threaded connections with O-ring seals made from solid stainless steel wire proved to be the best of the three types and were selected for in-reactor use. Tapered thread connections were found to be stronger than straight thread connections. Van Stone flange connections using Flexitallic gasket seals were satisfactory, but were rejected because of fabrication difficulties. Compression fitting connections with special nickel gasket seals were rejected as being too weak and unreliable for in-reactor use. (auth)

4787 NP-6557

Franklin Inst. Labs. for Research and Development, Philadelphia.

A BIBLIOGRAPHY ON GAS-LUBRICATED BEARINGS. Interim Report. Eugene B. Sciulli. Dec. 1, 1957. 97p. Contract Nonr-2342(00). (I-A2049-1).

4788 NP-6564(Pt. II)
Office of the Assistant Secretary of Defense (Research and Engineering), Washington, D. C.
SHOCK AND VIBRATION BULLETIN NO. 25. PART II. [Proceedings of] the 25th Shock and Vibration Symposium, held at Massachusetts Institute of Technology, Cambridge, on September 12-13, 1957. Dec. 1957. 345p.

The papers presented at the 25th shock and vibration symposium are presented in this volume. (W.L.H.)

4789
PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS. VOLUME XIV, NUMBER 2. C. V. Mahlmann and W. M. Murray, eds. Cambridge, Society for Experimental Stress Analysis, 1957. 209p.

Seventeen papers are presented in this volume on stress analysis. (W.L.H.)

4790
PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS. VOLUME XIV, NUMBER 1. C. V. Mahlmann and W. M. Murray, eds. Cambridge, Society for Experimental Stress Analysis, 1956. 224p.

Twenty-four papers are presented in this volume on stress analysis. (W.L.H.)

Heat Transfer and Fluid Flow

4791 AECU-3276
Princeton Univ., N. J.
ON THE DEVELOPMENT OF TAYLOR INSTABILITY. David Layzer. Aug. 1952. 15p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-3). $3.30(ph OTS); $2.40(mf OTS).

The history of the flow for an incompressible, inviscid fluid contained in a semi-infinite space and impressed with an infinitesimal disturbance is described in an approximate way for a certain class of simple initial conditions. The theory contains, as limiting cases, the linear theory and the steady-state theory of Davies and Taylor. (J.S.R.)

4792 AECU-3278
Princeton Univ., N. J.
A VARIATIONAL PRINCIPAL FOR THE MOTION OF INCOMPRESSIBLE NON-VISCOUS FLUIDS IN CONTACT. David S. Carter [1952?]. 8p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-5) $1.80(ph OTS); $1.80(mf OTS).

A variational principal for the motion of incompressible nonviscous fluids in contact, undergoing irrotational flow under the influence of an external force field, is given. The analysis is restricted to cases in which the fluids fill a region bounded by fixed walls and in which the interface between the fluids is simply connected. A Langrangian L is set up such that the equations of motion, including the boundary conditions governing the motion of the interface, are equivalent to the variational principal that $S_0^T L$ has a stationary value with respect to independent variations of the fluid motion and the interface motion. (J.S.R.)

4793 AECU-3280
Princeton Univ., N. J.
AN APPROACH TO THE NUMERICAL CALCULATION OF THE MOTION OF COMPRESSIBLE FLUIDS IN CONTACT. David S. Carter. [1953?]. 17p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-7). $3.00(ph OTS); $2.40(mf OTS).

A method is presented for the machine calculation of the motion of a pair of homogeneous compressible fluids in contact, using the "Lagrangian coordinates" in such a way that their finite difference approximations are obvious. The primary sources of inaccuracy are the repeated differencing that occurs in the mechanical equations and the distortion of the network as it moves with the fluid. (J.S.R.)

4794 AECU-3551
[California. Univ., Los Angeles].
A THEORETICAL ANALYSIS OF HEAT TRANSFER IN TURBULENT CONVECTION. Yan Po Chang. [1956?]. 29p. Contract [AT(11-1)-34]. $1.00(OTS).

The two cases of fully developed turbulent flow passing a flat plate at zero incidence and through a tube are considered. The laminar sublayer whose thickness is usually considered as constant at a given Reynolds number is postulated, in effect, to vary with the heat flow. The effect of natural convection is taken into account, despite its minor importance in predicting the heat transfer by forced convection in the turbulent regime. A general formula of Nusselt number is obtained as a function of Prandtl, Reynolds, and Grashof number. The heat transfer by natural convection alone becomes only a particular case and the Nusselt number is readily found by dropping out the term containing the Reynolds number. Calculated results agree excellently with experiments as conducted by previous investigators. (auth)

4795 AECU-3569
Columbia Univ., New York. Heat Transfer Research Lab.
REPORT ON BOILING HEAT TRANSFER. Novak Zuber. [Sept. 1957]. 7p. $0.50(OTS).

A brief compilation is made of Russian papers on boiling heat transfer and two-phase flow. (A.C.)

4796 AECU-3611
General Electric Co. General Engineering Lab., Schenectady, N. Y.
A LITERATURE SURVEY ON THE APPLICABILITY OF STEADY-STATE HEAT-TRANSFER COEFFICIENTS TO TRANSIENTS IN POWER OR IN FLOW WITH SINGLE-PHASE FLOW AND WITH TWO-PHASE FLOW. R. H. Norris. Nov. 1957. 19p. (57-GL-346). $3.30(ph OTS); $2.40(mf OTS).

A survey of all the known literature on the subject is presented. This survey consists of four parts and two appendices, namely: response of single-phase-fluid forced-convection heat transfer to a rapid change of velocity, response of single-phase-fluid forced-convection heat transfer to a rapid change of temperature of the surface or of the incoming fluid, response of single-phase-fluid free-convection heat transfer to a rapid change of the surface temperature or of the heat flux through the surface, response time for boiling heat transfer to sudden increase in heat flux, or in temperature of the wall, summary of range and nature of published test results on the response to a sudden rapid rise in heat input which brings a surface immersed in water to a temperature above the boiling point, and symbols—nomenclature. (auth)

4797 ORNL-2010
Oak Ridge National Lab., Tenn.
TEMPERATURE DISTRIBUTION IN FLAT PLATE WITH EXPONENTIAL HEAT SOURCE. F. T. Binford and M. L. Nelson. Feb. 1, 1956. 15p. Contract W-7405-eng-26. $0.20(OTS).

One of the important problems attendant to the design of a nuclear reactor is the calculation of the temperature distribution, due to gamma ray heating, in structural members in the vicinity of the core. In many cases these structural members can be represented as plates which are cooled by either natural or forced connection on one or on both sides and in some cases also on the ends. The present discussion is concerned with the case of a thin plate cooled on both sides and on one end by connection and in which an exponential source of heat exists. Such a situation might

arise in the case of a vertical plate oriented radially with respect to a reactor core. Under these circumstances one would expect a heat source to exist in the plate which varies exponentially in the y direction, is nearly uniform in the x direction, and is symmetric about the mid-point of the core in the z direction provided that the distribution of power density in the z direction is symmetric about the mid-point. Under this assumption, there will be no heat flow in the z direction at z = 0 and the maxumum temperatures will occur in the xy plane of the plate. Attention is confined to this case, and the assumption is made that the plate is thin enough so that variations of the heat source are negligible in the x direction. The latter assumption will result in a small positive error in the temperatures calculated and so the results will be conservative. (auth)

4798 WAPD-T-168

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

CONVECTIVE HEAT TRANSFER ANALYSIS BY ELECTRICAL ANALOG COMPUTER METHODS (thesis). John E. Nolan. 1955. 61p. $9.30(ph OTS); $3.60(mf OTS).

Submitted to the Univ. of Pittsburgh.

Methods for solving heat transfer problems, involving convective heat transfer, by electrical analog computer techniques were investigated. (W.L.H.)

4799 WAPD-TH-321

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

UPFLOW BURNOUT DATA FOR WATER IN RECTANGULAR CHANNELS AT PRESSURES FROM 600 TO 1870 PSIA. M. Troy. [Sept. 1957]. 29p. $4.80(ph OTS); $2.70(mf OTS).

Because of interest in operating reactors at pressures below 2000 psia, upflow burnout tests were performed on water at pressures from 600 to 1870 psia in vertical rectangular channels having length-to-equivalent diameter ratios (L/D) of 33, 153, and 242. (A total of about 90 burnout heat flux points were obtained, ranging from 0.134 to 2.26×10^6 Btu/hr-ft^2). The ranges of experimental variables (other than pressure) were mass velocities from 0.178 to 4.0×10^6 lb/hr-ft^2, inlet subcooling from 13 to 475°F, and exit qualities from 3 to 100% (See Table 1). In general, for all channels and pressures the burnout heat flux at given enthalpy increased as the pressure decreased. For the channel of L/D = 153 (at pressures below 2000 psia) the burnout heat flux at a given burnout point enthalpy appeared to increase from 40 to 110% with an increase in inlet subcooling of about 200°F. No such effect was observed with the other channels at any other conditions. The ranges of the ratio of measured to calculated burnout heat flux (calculated by the existing 2000 psia Thermal Design Criteria, Ref. 8), were 3.2 to 10.0 for the 0.101 in. × 1 in. × 6 in. channels, 1.3 to 7.3 for the 0.097 in. × 1 in. × 27 in. channels and 1.2 to 5.5 for the 0.059 in. × 1 in. × 27 in. channels. Efforts are underway to formulate new burnout design equations for these pressures below 2000 psia. (auth)

4800 NP-tr-1

A NEW METHOD FOR THE INVESTIGATION OF HEAT TRANSFER IN THE BOILING OF LIQUIDS. P. G. Poletavkin, V. I. Petrov, L. D. Dodonov, and I. T. Aladyev. Translated from Doklady Akad. Nauk S.S.S.R. 90, 775-6 (1953). 3p.

Materials Testing

4801 KAPL-M-EDL-11

Knolls Atomic Power Lab., Schenectady, N. Y.

SURVEY AND TESTS OF BOLTS. J. H. Germer. Apr. 10, 1954. 33p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

An investigation was conducted of the experience, criteria, and recommendations of various divisions of General Electroc Co. and a leading manufacturer. Abstracts and summaries of the information obtained from these sources that is pertinent to bolting in liquid metal systems are given. (L.T.W.)

4802 WAPD-PWR-PMM-1516

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

METALLOGRAPHIC EXAMINATION OF ZIRCALOY CLADDING FROM THE CR-S-21 HOT WATER LOOP TEST. Interim Report No. 8. F. O. Bingman, Jr. and L. J. Jones. [Oct. 1957]. 7p. $1.80(ph OTS); $1.80(mf OTS).

The test consisted of the irradiation of one Zircaloy-2 clad UO_2 fuel element with a 0.006 in. diameter hole. The purpose of the test was to compare fission product evolution from a defected fuel element. Metallographic examination showed little or no UO_2 visible in the section of Zircaloy-2 cladding. The specimen was examined at four transverse sections. (W.L.H.)

4803 IGRL-T/C-43

IRREVERSIBLE CHANGES IN LENGTH OF ZINC UNDER THERMAL STRESS. K. Claus and K. Lohberg. Translated by J. Standring from Z. Metallk. 46, 582-8(1955). 17p.

By heating of worked high-purity zinc (99.995%) changes of length have been observed previously. Supplementary experiments are described which permit an analysis of the processes as well as a generalization and explanation of the reasons for their origin. By thermal cycling treatment changes of length could be produced even with slow temperature changes leading partly to the destruction of the specimen. The changes in length increase continuously with the number of temperature cycles and the size of the temperature interval traversed. Their magnitude is strongly dependent on the texture of the specimens. The origin of the deformation is explained by the anisotropy of the thermal expansion coefficient and the crystal shear stress of the zinc crystal. During recrystallization and grain-growth of extruded and strained pure zinc, changes in length occur in the direction of deformation. They are caused by the simultaneously occurring changes in thermal expansion coefficients. From the accompanying change of the elastic modulus and from single crystal data these are related to a change in texture. The changes in length can be positive or negative according to annealing temperature. They are strongly dependent on ductility (texture). An effect of these length changes on the creep rate is to be expected if the recrystallization process extends over a long time. (auth)

Radiography

4804 AEC-tr-3128

EXPOSURE DIAGRAMS FOR X-RAY FILM WORK ON TITANIUM AND ZIRCONIUM. K. Sagel. Translated by K. S. Bevis from Metall 11, 769(1957). 2p.

The increasing use of titanium and zirconium metals as construction materials and the concurrent increasing importance of x-ray analysis make it desirable to determine the amount of exposure required in producing useful x-ray diagrams for these materials. Exposure charts are given for titanium and zirconium. (A.C.)

Waste Disposal

4805

TREATMENT AND DISPOSAL OF FUEL-REPROCESSING WASTE. Joseph A. Lieberman (U. S. Atomic Energy Com-

mission, Washington). Nucleonics 16, No. 2, 82-9(1958) Feb.

The problems of the treatment and disposal of radioactive wastes are reviewed. Waste characteristics, predisposal treatment, solid preparation and fixation, and ultimate disposal are the factors considered. (J.S.R.)

4806

HIGH-PURITY EVAPORATOR FOR WASTE CONCENTRATION. T. C. Carnavos and J. W. Hagen (Griscom-Russell Co., Massillon, Ohio). Nucleonics 16, No. 2, 125-7(1958) Feb.

A remotely operated evaporator for processing radioactive material was designed which accomplishes a threefold reduction in waste volume with concentration to 70% salt content. The evaporator, with sloped sides to prevent accumulation of solids and a concentrate discharge line located at the lowest point of the bottom, has a low-vapor disengaging rate and high headroom to promote natural separation of water and vapor. The mist eliminator is capable of reducing entrainment by factors of 10^3 to 10^4. A bowed tube heating section permits scale shedding by thermal shock. (J.S.R.)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

4807 BIOS-Misc/R-107

British Intelligence Objectives Sub-Committee.

GENERAL SURVEY OF WORK BY DR. RYSCHKEWITSCH LARGELY IN FIELD OF CERAMICS. PARTS I THROUGH V. [1946]. 112p.

Research is reported on the development of ceramic materials for use with extremely high temperatures. Topics discussed include the preparation of oxides of Al, Be, Th, Mg, and Zr; the preparation of elementary boron and boron nitride; the yielding strength of carborundum bonded with ceramics; determination of the bending strength and shear modulus of some pure oxide ceramic materials; and the chemical resistivity of sintered oxides. (C.H.)

4808

CHARACTERIZATION OF SINTERABLE OXIDE POWDERS. I. BeO. J. F. Quirk, N. B. Mosley, and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 40, 416-19(1957) Dec.

The discovery of readily sinterable BeO powder facilitated the production of dense, high-strength BeO ceramics and created interest in the properties and preparation of sinterable BeO. BeO powders prepared by the thermal decomposition of $Be(OH)_2$ were studied in an effort to relate sinterability with other more basic characteristics of the oxide powder. Different BeO powders made from analyzed hydroxides showed a wide range of sinterability. The temperatures required for sintering the powder compacts to theoretical density ranged from 2300° to above 3200°F. Lattice parameters, thermal decomposition, surface areas, and refractive indices were determined on these powders after calcination in air at 750°, 1470°, 1830°, and 2190°F. Although unexpected variations in these properties were observed, no simple relation with sinterability was found. Occluded and surface impurities appeared to have a critical effect on sintering behavior. (auth)

Corrosion

4809 AECU-3609

Case Inst. of Tech., Cleveland.

SCALING OF ZIRCONIUM AT HIGH TEMPERATURES. Technical Progress Report No. 4. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Dec. 1957. 19p. Contract AT(11-1)-258. $3.30(ph OTS); $2.40(mf OTS).

A proposed mechanism of growth of Zr requiring the presence of a ZrN layer next to the metal was presented. In the light of the present work this mechanism now requires some qualifications since growth has been observed in pure O_2 with impure grades of Zr. While duplex scaling runs have shown that gaseous impurities, mainly O_2 and N_2, do alter the scaling reactions in air, these data indicate that growth of impure material in O_2 is not caused by these gaseous impurities. Therefore, it is now necessary to study the effects of other impurities in an effort to reconcile the growth in O_2 of impure Zr and the absence of growth of the purer Zr in O_2. (auth)

4810 AERE-M/R-1924(Del.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RESISTANCE OF ZIRCONIUM AND ITS ALLOYS TO HIGH TEMPERATURE WATER. C. F. Britton and J. N. Wanklyn. Mar. 1956. 26p.

Corrosion tests of binary and ternary alloys of Zr and of Zircaloy-2 in demineralized water at 325°C are described. In binary alloys Sn, Nb, and Ta in amounts up to 5 wt. % reduce corrosion rates but do not prevent "breakaway", i.e., the change from a rate which falls with time to a constant but higher rate. Tin is a more effective addition than either Ta or Nb. Breakaway is delayed by the further addition to Sn alloys of Fe, Ni, or Cr singly or in combination in amounts up to about 0.5 wt. %. In binary alloys containing 0.5 wt. % of Sn, ternary additions of Cr are less effective than Fe or Ni. It is concluded that the function of Sn is to counter the harmful effect of N in the metal and that, although Fe, Ni, and Cr have not this power, good corrosion resistance requires their presence to prevent breakaway. Preliminary experiments show that the latter may be induced by making the specimen a cathode during exposure to water at 325°C. (auth)

4811 BMI-1242

Battelle Memorial Inst., Columbus, Ohio.

EVALUATION OF CONTAINER MATERIALS FOR ZIRCEX AND DAREX NUCLEAR-FUEL-RECOVERY PROCESSES. Paul D. Miller, Charles L. Peterson, Earl L. White, and Frederick W. Fink. Dec. 11, 1957. 44p. Contract W-7405-eng-92. $1.25(OTS).

The selection of a suitable material for the processing equipment is most important in fuel-recovery processes. The problem arises because of the aggressive nature of the reagents that must be used for disintegrating or dissolving some spent fuel elements. In this investigation, corrosion tests were made under conditions simulating those that may occur in several proposed processes in order that candidate materials of construction could be evaluated. No material has been found which would allow both the hydrochlorination and dissolution steps of the vapor-phase Zircex process to be carried out in a single vessel. For a two-vessel process, several materials, such as Inconel, Haynes 25, Type S-816 alloy, Illium R, and the Hastelloys B and C, appear promising for construction of a hydrochlorinator; the dry residue would then be transferred to another vessel, perhaps of titanium or tantalum, for dissolution. In the alternate liquid-phase Zircex process, preliminary tests have given promising results

with nickel and nickel-chromium alloys. However, the only metals studied, which withstand the corrosive boiling $AlCl_3 \cdot NH_4Cl$ plus gaseous HCl environment with but negligible weight losses have been platinum, gold, tungsten, and molybdenum. A variety of laboratory studies have shown that titanium will apparently withstand any condition likely to occur in the critical areas of the Darex process, including the dissolver and chloride-stripping column. It will undergo a severe attack in HCl vapor, but this is easily prevented by the presence of a small amount of nitric acid vapor or oxides of nitrogen. Tantalum is another promising material disclosed by these tests, but its use in the dissolver seems negated because embrittlement was detected under certain conditions. No signs of cracking or other attack have been observed on Type 347 stainless steel specimens exposed at room temperature with various levels of stress for over 6 months to Purex-type acid extraction systems containing chlorides far in excess of the concentrations expected during operation of either the Zircex or Darex head-end processes. (auth)

4812 CF-57-10-80
Oak Ridge National Lab., Tenn.
SOLUTION CORROSION GROUP QUARTERLY REPORT FOR THE PERIOD ENDING OCTOBER 31, 1957. J. C. Griess, H. C. Savage, J. L. English, R. S. Greeley, S. R. Buxton, D. N. Hess, P. D. Neumann, S. E. Bolt, and W. C. Ulrich. Oct. 31, 1957. 39p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A fifth test of the HRT core-pressure-vessel flange and transition mockup was made. No leakage occurred. Metallographic examination has shown the occurrence of stress-corrosion cracks on the outside of a straight section of type 347 stainless steel pipe exposed to a tap and demineralized water spray. A hydride phase was found metallographically in a Ti–75A sample holder exposed to UO_2F_2 and in a Ti insert exposed to O_2-free UO_2SO_4. It was shown that SO_4^{2-} inhibits corrosion of stainless steel in UO_2SO_4 at 250°C. The initial run in the new all-Ti loop, loop H, gave low corrosion rates on pretreated stainless steel coupons. The second run gave higher corrosion rates which may be due to a difference in pretreatment of coupons. Films formed on stressed type 347 stainless steel by exposure in boiling and aerated chloride-free UO_2SO_4 solution were found to provide at least some protection to the alloy from stress corrosion cracking when exposed in a similar solution containing chloride ions. A number of alloys of Zr were tested in simulated HRT fuel solution. (For preceding period see CF-57-7-121.) (W.L.H.)

4813 WAPD-A1W(PCh)-473
[Westinghouse Electric Corp., Atomic Power Div., Pittsburgh.]
REPORT ON NALCO TEST III OF THE OUT-OF-PILE NUCLEATE BOILING PROGRAM. R. T. Esper. [1957]. 21p. $4.80(ph OTS); $2.70(mf OTS).

Results of an investigation of the surface effects of nucleate boiling on Zircaloy-2 are presented. (W.L.H.)

4814 WAPD-PWR-CP-2921
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
CORROSION AND EROSION OF SINTERED UO_2 COMPACTS IN HIGH TEMPERATURE WATER. J. M. Lojek and W. T. Lindsay, Jr. [Mar. 1957]. 34p. $6.30(ph OTS); $3.00 (mf OTS).

Attached to this report is a letter (WAPD-PWR-CP-2922), by Paul Cohen, containing pertinent information. 2p.

Corrosion tests of bare, cold-pressed, and sintered UO_2 pellets have indicated that high O_2 concentrations in the coolant at operating temperatures will result in oxidation of the exposed UO_2 at neutral, high, or low pH conditions. Erosion rates were obtained and data are given. (W.L.H.)

4815 WAPD-PWR-CP-3166
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
THE EFFECT OF OXYGENATED WATER ON CLAD-AND-DEFECTED UO_2 FUEL SPECIMENS. J. M. Lojek and W. T. Lindsay, Jr. [June 1957]. 25p. $4.80(ph OTS); $2.70 (mf OTS).

Small pits were found in the surfaces of the pellets directly beneath the defects. The pattern of surface discoloration indicated that water had circulated through the annular gap between the pellet and the cladding of the test rods which contained 2 defects. The weight changes of the pellets were variable, but small. In 2 duplicate runs, the weight losses for the most severely attacked clad pellets were less than those for unclad pellets by factors of 84 and 12. It is concluded that defected cladding offers sufficient protective effect so that any air-addition accident of plausible extent and duration will not adversely affect deffected PWR fuel rods. (auth)

4816 WAPD-TM-97
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CORROSION TESTING OF ZIRCALOY-2 AND ZIRCALOY-3. S. Kass. Oct. 1957. 32p. Contract AT-11-1-GEN-14. $1.00(OTS).

Zircaloy-2 and Zircaloy-3 have found extensive applications in water cooled and moderated reactors due to their excellent corrosion properties in high-temperature water and steam. These excellent corrosion properties are inherent in the alloys; however, the corrosion behavior in high-temperature water and steam is greatly influenced by sample surface preparation and the manner in which the test is conducted. This report is concerned with the external factors influencing the corrosion behavior of the zirconium alloys. (A.C.)

Geology and Mineralogy

4817 GS-P-297-A
Geological Survey.
GEOLOGY AND BERYL DEPOSITS OF THE PEERLESS PEGMATITE, PENNINGTON COUNTY, SOUTH DAKOTA. PEGMATITES AND OTHER PRECAMBRIAN ROCKS IN THE SOUTHERN BLACK HILLS. Douglas M. Sheridan, Hal G. Stephens, Mortimer H. Staatz, and James J. Norton. 1957. 50p, 4 illus. $1.50(GPO).

The Peerless pegmatite, half a mile south of Keystone, Pennington County, S. Dak., has been a major source of scrap mica and beryl. Feldspar, amblygonite-montebrasite, tantalite-columbite, and cassiterite also have been recovered. The pegmatite intrudes Precambrian quartz-mica schist. Much of the schist contains staurolite and chlorite. Staurolite has been, in part, altered to mica, quartz, and chlorite, especially near pegmatite contacts. The pegmatite is generally discordant with the schist, but in many places a secondary schistosity has been formed parallel to the contact. Tourmaline and muscovite, presumably introduced by pegmatitic solutions, are characteristic of the wall rock near discordant contacts. At the surface the pegmatite has a tadpole shape, and is 580 feet long and 360 ft wide. In cross section the pegmatite has an anticlinal shape that indicates control of the intrusion by fractures bearing N. 30° W. and dipping 45° NE. and SW. Dikelike apophyses extending from the main pegmatite have several attitudes. The Peerless is a complex pegmatite consisting of 7 zones, 2 replacement units, and 2 types of fracture fillings. The zones are as follows: 1, quartz-muscovite-plagioclase pegmatite (border zone); 2, albite-quartz-muscovite pegmatite (wall zone); 3, cleavelandite-quartz-muscovite pegmatite (first interme-

diate zone); 4, perthite-cleavelandite-quartz pegmatite (second intermediate zone); 5, cleavelandite-quartz pegmatite (third intermediate zone); 6a and 6b, quartz-microcline pegmatite and quartz pegmatite (fourth intermediate zone); and 7, lithia mica-cleavelandite pegmatite (core). The other units are: lithia mica-cleavelandite-quartz replacement unit; muscovite-cleavelandite replacement unit; quartz fracture fillings; and tourmaline-quartz fracture fillings. The structural, textural, and mineralogic data confirm previously published evidence from other Black Hills pegmatites that indicates crystallization of a magmalike fluid from the wall inward. Repetition of layers in zones 1 and 2 indicates changes in composition of the fluid at the crystallizing face. These changes may have been caused by addition of new material from below, by loss of material to the wall rocks, or by failure of convection to maintain equilibrium throughout the fluid in the pegmatite chamber. Zones 3 to 7 are in the normal sequence of zoned pegmatites that indicates crystallization from a restricted or nearly closed system. The lithia mica-cleavelandite-quartz replacement unit, which extends outward from the core, shows that in the very late stages of crystallization a pneumatolytic or hydrothermal fluid escaped outward and replaced previously crystallized pegmatite. Zone 3, the principal minable unit, contains 1.7% beryl and 28% scrap mica. Beryl also constitutes more than 1% of parts of the wall zone, especially albite-rich layers of the inner part of the unit in the upper part of the pegmatite. Beryl is a less important constituent of other units of the pegmatite. Potash feldspar is mined chiefly from zone 4. Cleavelandite that can be hand cobbed and sold as soda feldspar occurs in zones 3, 4, and 5. Amblygonite-montebrasite constitutes between 0.5 and 1.0% of zone 5. Reserves of beryl, scrap mica, potash feldspar, and amblygonite-montebrasite are one to six times past production. (auth)

4818 ORO-167

Tennessee. Univ., Knoxville.

AN INVESTIGATION OF THE CHATTANOOGA BLACK SHALE OF TENNESSEE AS A SOURCE OF URANIUM. Progress Report for July 1, 1956 to June 30, 1957. Harry J. Klepser. Aug. 1, 1957. 10p., 1 illus. Contract AT-(40-1)-1337. $0.50(OTS).

The primary aim of this study is to present as complete a geologic picture as possible of the Chattanooga shale in its outcrop area of the Eastern Highland Rim and the Northern Highland Rim of Tennessee and adjacent Kentucky. Special emphasis has been placed upon the stratigraphic relationships and their implications upon the age and manner of origin of the sediments and upon the origin, source and distribution of U in the shale. The study has consisted of both field and laboratory investigations. (auth)

4819

CLAY ALTERATION AND ORE, TEMPLE MOUNTAIN, UTAH. Dana R. Kelley and Paul F. Kerr (The Texas Co., Farmington, N. Mex. and Columbia Univ., New York). Bull. Geol. Soc. Am. 68, 1101-16(1957) Sept.

The Moss Back Sandstone at Temple Mountain, Utah, exhibits abundant argillic alteration in the grain interstices. Near collapse features and close to ore zones the principal clay minerals, kaolinite and illite, become more abundant. Aggregate birefringence and particle size appear to increase. Specific types of illite also develop. Mixtures of 1M and $2M_1$ mica polymorphs are typical. The $2M_1$ mica-clay polymorph also becomes a more abundant constituent of mixtures. Near collapse areas, microvermicular aggregate growths of kaolinite become common. In unaltered and nonore-bearing sediments, the $2M_1$ mica-clay polymorph has not been observed. Where scattered detrital flakes of $2M_1$ muscovite are found along bedding planes in the unaltered sediments, they appear to be breaking down to a 1M structure. Hydrothermal synthesis of micas by Yoder and Eugster (1955) has shown the transition of 1M to $2M_1$ mica polymorphs which appears to occur between 200°C and 350°C at 15,000 psi water pressure. The illite at Temple Mountain which contains the $2M_1$ polymorph is believed to have been deposited by hydrothermal solutions accompanying urano-organic ore deposition. Natural conduits for circulation appear to have been provided by the collapse features and by fractures. The source of the clay-forming elements is probably not only the original interstitial material but also includes detrital feldspar replaced during the development of ore masses. (auth)

Metals and Metallurgy

4820 AECU-3610

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SPECIAL ZIRCONIUM ALLOYS. Report No. 18 (Summary) [for] January 1, 1956–October 31, 1957. R. F. Domagala and David W. Levinson. Oct. 15, 1957. 58p. Project No. B 100. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 903. $9.30(ph OTS); $3.60(mf OTS).

Tensile properties and impact strengths were determined for iodide Zr, sponge Zr, and alloys based on both grades of metal, containing nominally 1.5% Sn. Sheet specimens, welded and unwelded, were tested. Tensile properties were established at room temperature and 300°C. Impact strength values were measured at −100°, R.T., 100°, 200°, and 300°C. These (alpha) materials generally exhibited a lack of heat treatability, little or no deterioration of properties due to welding, and essentially no indication of impact transition temperature. Tensile strength and impact behavior were established for alloys based on iodide zirconium containing 15% Nb, 15% Nb + 2% Pd, 15% Nb + 2% Pt, 15% Nb + 1% Fe, and a binary sponge zirconium + 15% Nb alloy. High strength levels could be established by proper heat treatment. The presence of Pd, Pt, or Fe seemed to delay the formation of the embrittling agent as determined by hardness and resistivity vs time of anneal curves for these alloys. (auth)

4821 AGARD-96

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

TITANIUM FABRICATION. L. P. Spalding. Apr. 1957. 38p.

Presented at the Fifth Meeting of the Structures and Materials Panel, Apr. 24 to 27, 1957, in Oslo, Norway.

A description is given of the problems encountered and the techniques evolved for their solution during the manufacture of some two thousand air-planes incorporating about a million pounds of titanium in their designs. Primary emphasis is given to titanium alloy sheet applications. (auth)

4822 AGARD-100

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

THE MECHANICAL AND ENGINEERING PROPERTIES OF COMMERCIALLY AVAILABLE TITANIUM ALLOYS. H. V. Kinsey. Apr. 1957. 19p.

Presented at the Fifth Meeting of the Structures and Materials Panel, Apr. 24 to 27, 1957, in Oslo, Norway.

The titanium alloys being produced on a commercial basis up to early 1957 are listed. Nominal chemical compositions and manufacturer's designations for these alloys are given. An attempt has been made to collect all

the published data on the physical, mechanical, and engineering properties of these alloys and to indicate those properties required by the aeronautical design engineer that are not available. (auth)

4823 AGARD-102

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

ALUMINIUM ALLOYS IN AIRCRAFT STRUCTURES. G. Meikle. Apr. 1957. 15p.

Presented at the Fifth Meeting of the Structures and Materials Panel, Apr. 24 to 27, 1957, in Oslo, Norway.

Details of compositions of three groups of Al alloys used in the United Kingdom are discussed in relation to alloys used in the U.S.A. The properties of these alloys at elevated temperatures are mentioned particularly with regard to the effect of time and temperature, this being of great importance where kinetic heating is involved. The different nominal compositions of the high strength Al–Zn–Mg alloys used in the United Kingdom are dealt with, and some of the difficulties experienced with stress-corrosion in this type of alloy are mentioned. Research at the Royal Aircraft Establishment on this problem is briefly mentioned with particular reference to the effect of chemical composition and heat treatment. Brief reference is made to a possible Al alloy for use at temperatures up to 200°C. (auth)

4824 ANL-5717

Argonne National Lab., Lemont, Ill.

METALLURGY DIVISION QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, AND MARCH 1957. Mar. 31, 1957. 67p. Contract W-31-109-eng-38. $2.00(OTS).

Advanced Water Reactor Program. The second fuel loading for the EBWR is planned as ThO_2–UO_2. Some properties of ThO_2–UO_2 systems are presented. Fast Power Breeder Reactor Program. The development of casting techniques for EBR-1, Mark III extrusion billet cores are described. The investigation of methods for the remote refabrication of irradiated reactor fuels was undertaken with the objective of designing, constructing, and testing techniques and equipment for the refabrication of EBR-II fuels. Advanced Engineering and Development. From observations and photographs made during disassembly operations, and from chemical, metallographic, and density measurements, it was possible to reconstruct the probable physical structure of the core after the meltdown of the EBR-1 core. A boiling experiment was performed to give preliminary information as to whether thermal decomposition or volatility would complicate the use of H_3PO_4 solution in boiling reactors. Due to the possible use of Mg as a cladding material a few preliminary corrosion tests were made with distilled water. Cylindrical, NaK-filled Zr irradiation capsules, which suddenly broke open during decanning operations following irradiation, were examined in an effort to determine the role of irradiation in these unexpected failures. Production, Treatment, and Properties of Materials. Elastic constants of alpha-U single crystals in three directions were obtained. Recrystallization of heavily cold rolled U sheet was studied. Two ingots of high-purity U was used to study the melting point of U. The eutectic temperature measurements of U–UC alloy are presented. The α–β transformation temperatures of high-purity U were studied. Phase diagrams are presented for the U–Ru, U–Ru–Mo, and U–Mo alloys. (For preceding period see ANL-5709.) (W.L.H.)

4825 BMI-1232

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING OCTOBER 1957. Russell W. Dayton and Clyde R. Tipton, Jr. Nov. 1, 1957. Decl. Dec. 6, 1957. 58p. Contract W-7405-eng-92. $1.50(OTS).

The creep properties of annealed Zircaloy-2, Zircaloy-3, and 15% cold-worked Zircaloy-2 at elevated temperatures were determined. The metallurgical bond formed between electropolished U and Zr cladding by hydrostatic pressing is being evaluated. Oxidation data are given for Nb and Nb alloys in dry air at various temperatures. A study of the phase relationships which occur between the delta phases of the U–Zr and U–Mo systems is nearly complete. The solid-solid reactions of some uranium nitrates and carbides at 1800°C are given. The creep properties of Ta at 1200°F in a helium atmosphere were investigated. (For preceding period see BMI-1226.) (W.L.H.)

4826 CF-58-1-27

Oak Ridge National Lab., Tenn.

INSPECTION OF INOR-8 TUBING FROM WALLINGFORD STEEL COMPANY. R. W. McClung. Jan. 9, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The Nondestructive Test Development Group evaluated approximately 600 ft of $\frac{1}{4}$-in. O. D. × 0.025-in. wall Inor-8 tubing. This was a special lot which had been fabricated as part of a program to determine the fabricability of the Ni–Mo alloy, Inor-8. The major part of the evaluation was conducted with the immersed ultrasonic technique and the encircling coil, eddy-current method, although some additional work was done with fluorescent penetrants and radiography. As a result of this evaluation, 60% of the tubing was found to be free of significant discontinuities. On the remaining 40%, approximately 50 discrete discontinuities were noted and marked. Metallographic sections of several of these discontinuities were taken to determine their nature. The most common defect type was the lamination or lamination-like precipitate. Approximately one-half of the metallographic sections contained conditions similar to this. Also noted were several crack-like voids. A few very tight cracks were also detected. All of these defects were detected and precisely located by ultrasound. Despite the number of discrete defects located in this batch of tubing, it is considered to be the best Ni–Mo alloy tubing inspected by this laboratory to date. (auth)

4827 EMRL-9

Brown Univ., Providence. Engineering Materials Research Lab.

A STATISTICAL METHOD FOR DETERMINING FATIGUE STRENGTHS WITH A LIMITED NUMBER OF SPECIMENS. Technical Report No. 5. J. J. Coleman and W. N. Findley. June 1957. 23p. DA Project No. 5899-01-004. Contract DA-19-020-ORD-3520. (AD-137032).

Since results of fatigue tests show considerable scatter, any resonable estimate of fatigue strength has to be made on a statistical basis. The statistical method developed is considered to yield optimum accuracy in determining the fatigue strength at a given number of cycles with a limited number of specimens. By the proposed method specimens are tested in sequence using a slope-intercept device to insure convergence of the data about a predetermined number of cycles to failure. The method of least squares is then employed to estimate the mean value of the fatigue strength. The relative error of the estimate is determined by use of the Student t-distribution. Possible variations of the method are discussed. Application of this procedure to SAE 1020 steel is presented. (auth)

4828 ISC-832

Ames Lab., Ames, Iowa.

ALLOYS OF ALUMINUM, THORIUM AND URANIUM. Gene E. Bobeck and H. A. Wilhelm. Dec. 1956. 30p. Contract W-7405-eng-82. $1.00(OTS).

The Al-rich corner of the ternary alloy system Al–Th–U has been investigated by thermal and microscopic

analyses to determine an area of low-melting alloys that could be used as a liquid metal fuel in U^{233} breeder reactors. A phase diagram of this Al-rich corner of the system has been proposed. The data indicate that the binary eutectic valleys from the Al–U and Al–Th systems meet at a point in the neighborhood of the composition of 76 wt. % Al, 18 wt. % Th, and 6 wt. % U to give a ternary eutectic which solidifies at 630°C. Although microstructures indicate two different primary phases as required, a third binary valley leading to this ternary eutectic has not been established. Results of the investigation show that there is a rather wide range of compositions of U and Th in Al, varying from 13 wt. % U at zero wt. % Th to zero wt. % U at 25 wt. % Th, that can be maintained in a one-phase liquid solution at temperatures even lower than 640°C. If a temperature of 650°C is the minimum, then an even wider variation in U and Th compositions can be tolerated for a single liquid-phase alloy. (auth)

4829 KAPL-M-WMC-5

Knolls Atomic Power Lab., Schenectady, N. Y.

CONCERNING FUEL COMPOUNDS. William M. Cashin. Jan. 1957. 11p. Contract [W-31-109-eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

The paper reviews in general the requirements of a nuclear fuel compound with regard to irradiation and thermal stability when structural integrity is expected therein. Background work on somewhat similar materials such as boron carbide is presented, and various types of refractory inorganic materials are discussed in terms of their expected potential as a nuclear fuel. (auth)

4830 NAA-SR-2069

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A PHYSICAL METALLURGICAL STUDY OF THORIUM-RICH, THORIUM–URANIUM ALLOYS. Gordon G. Bentle. Jan. 15, 1958. 28p. Contract AT-11-1-GEN-8. $1.00 (OTS).

Physical property measurements and metallography were performed on Th-rich Th–U alloys containing up to 20 wt. % U. Tensile tests at 500°C indicate that when commercial-grade Th is alloyed with U the ultimate and yield strengths are increased approximately 50%. Hardness data at room temperature are also presented. Photomicrographs indicate that the U is dispersed uniformly as fine particles in arc-melted alloys. These fine particles coalesce when the material is annealed; some of the particles coalesce at the grain boundaries. Alloys containing up to five wt. % U appear to retain very few of the particles which coalesce along the grain boundaries; most of the particles appear in the matrix. The Th-rich end of the Th–U phase diagram is presented; it is based on electrical resistivity and lattice-parameter measurements. The variation of thermal conductivity with temperature, up to 1100°C, in Th alloys is calculated and the resultant data are tabulated. (auth)

4831 NMI-4701

Nuclear Metals, Inc., Cambridge, Mass.

PROGRESS REPORT TO HANFORD ATOMIC PRODUCTS OPERATION, GENERAL ELECTRIC CO. [FOR] MARCH 15, 1957 THROUGH JUNE 15, 1957. H. F. Sawyer. Aug. 23, 1957. 24p. Contract AT(30-1)-1565. $4.80(ph OTS); $2.70(mf OTS).

Uranium fuel elements clad with Zircaloy and with integral end seals of Zircaloy are being developed by the coextrusion process. (For preceding period see NMI-4700.) (W.L.H.)

4832 NP-6546

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Summary Report No. 1 [for] March 15, 1955 to October 31, 1957. J. D. Walton, N. E. Poulos, and C. R. Mason. 213p. Project No. A-212. Contract NOrd-15701.

Tables of melting points and densities are given for refractory metals, hard metals, and oxides. Coating of Mo-sheet substrates with Al, Au, Ni, Pt, Rh, and Si as single films by evaporation, sputtering, or electroplating is described. Methods of applying and forming thick protective coatings for high temperature service are arc evaporation, hot dipping, flow, cementation, vapor decomposition, and thermite fired ceramic coatings. An attempt to apply thick Al coatings to glass, Cu, and Mo using the arc evaporator is described. Hot dipping, flow, cementation, and vapor decomposition were used to form the silicides of Mo on the surfaces of Mo stock. Hard nonporous glazes, hard porous glazes and hard powdered structures have been obtained. The adherence between the coatings and a steel substrate was not good, the coating sheared off as a complete unit because of thermal expansion differences. Methods of spraying molten coatings directly onto a substrate were investigated. Aluminum, Mg, and mild and stainless steel sheet were coated with alumina and zirconium silicate by flame spraying. Flame and arc fusion methods were studied as means of fusing and spheroidizing coating materials for flame-spraying. Cermet coatings consisting of Al_2O_3 and Al were applied to mild steel by the Thermo Spray process. Experiments with exothermic, (card 2) NP-6546 (Rpt: UNCLASSIFIED) thermitic type coatings for metals pointed to the possibility that these coating materials might have use as structural materials. Studies of thermitic mixes of oxides of Cr, Co, Fe, Mn, Mo, Ni, Si, Ti, V, and Zr were made. Extensive time was devoted to the development of techniques for producing thermitic cermets free of internal stress cracks, varying porosity, warping, and cracking. Determinations of the modulus of rupture and elevated temperature tensile strength of the thermitic cermets were studied. Fabrication of rocket nozzles from a castable fused silica body is described. Additives (such as resins, cermets, and graphite) which might increase the strength and thermal conductivity of dry pressed nozzles were studied. (W.L.H.)

4833 NP-6552

Loewy Hydropress Div., Baldwin-Lima-Hamilton Corp., New York.

EVALUATION OF EXTRUDABILITY OF TITANIUM ALLOYS AND ALLOY STEEL. A. Tesmen and George Birman. [1957]. 119p. Contract DA-30-069-ORD-963.

A total of 160 commercially pure and Ti alloy billets and 61 steel billets were extruded under various conditions on a 4000 ton press using 6.9 in. diameter billets. The extrudability of these metals is reported in terms of extrusion pressure as a function of reduction ratio, extrusion temperature and two lubrication practices. Effects of glass lubrication are compared with those of a practice employing graphite–MoS_2 grease. A promising method of extruding Ti without lubrication was developed. (auth)

4834 NYO-4772

Massachusetts Inst. of Tech., Cambridge.

DEFORMATION RESULTING FROM GRAIN BOUNDARY SLIDING. Hans Brunner and Nicholas J. Grant. Dec. 1957. 31p. Contract AT(30-1)-1973. $6.30(ph OTS); $3.00(mf OTS).

The determination of equations relating elongation to the amount of shear taking place both along grain boundaries and in slip planes of polycrystalline aggregates during creep was studied. Certain discrepancies with previously

used equations are pointed out. Grain boundaries were observed to become "rumpled" during creep, but it is shown that this does not necessarily prevent further grain boundary sliding. Direct observations of subgrain boundary migration lead to the conclusion that this migration facilitates sliding along rumpled grain boundaries. An attempt is made to determine the magnitude of the hydrostatic stress along the edges of the grains (at the triple points on the specimen surface) during creep. Contrary to popular opinion, this is still an unsolved problem. (auth)

4835 NYO-4871

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Progress Report. Oct. 31, 1957. 39p. Contract AT(30-1)-956. (MITS-37).

The adsorption of inorganic and organic ions on quartz is described. The solubility rates of quartz in solutions containing HF are presented. The ion exchange properties of musconite were investigated. A study of surface exchange and diffusion with Zn^{65} on zinc sulfide is presented. (W.L.H.)

4836 NYO-7076

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE EFFECT OF COLD WORK ON LOCAL ORDER. Technical Report No. 20. P. S. Rudman and B. L. Averbach. Sept. 30, 1955. 9p. Contract AT-(30-1)-1002, Scope III. $0.15(OTS).

The local order in a polycrystalline 85 Cu–15 Au (atomic percent) alloy has been measured in the annealed and in the severely cold worked state by an x-ray method. The working was accomplished by abrasion, and it is shown that about 50 percent of the short range order is destroyed by severe plastic deformation. This result also leads to the conclusion that slip occurred on about one-third of all the available {111} planes in this instance. An attempt was made to calculate the energy associated with the randomization. (auth)

4837 NYO-7707

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Apr. 30, 1957. 38p. Contract AT(30-1)-956. (MITS-35). $1.00(OTS).

An electrochemical titration technique was used to investigate the electrical condition existing at the silver sulfide–solution interface and its influence on the adsorption of dodecylammonium acetate under different conditions. Investigation of the adsorption of inorganic ions on quartz continued. Rate studies were made of the dissolution of quartz in solutions of moderate HF concentrations. The ion exchange properties of muscovite were investigated. Solvent extraction of Cr^{3+}, Fe^{3+}, and Mn^{2+} from thiocyanate solutions is described. A device was developed that enables continuous determination of pulp density at any given instant and position in a settling pulp. (W.L.H.)

4838 RPL-16/12

Watertown Arsenal. Rodman Process Lab., Mass.

INDUCTION MELTING PROCESS FOR TITANIUM SCRAP. P. J. Ahearn and C. F. Frey. Apr. 1957. 10p. (PB-131241).

A number of 20 to 25 lb Ti ingots were produced from Ti–6Al–4V scrap. The heats were melted in a high-frequency induction furnace under an inert atmosphere. Contamination of the heat by the graphite crucible was minimized by the use of a Ti skull in the bottom of the crucible and by adjustments in the power input so that a meniscus would be obtained in the molten Ti and thus reduce contact between the metal and the graphite crucible. Production of 20 to 25 lb heats of Ti is possible by this induction melting technique. The physical properties of some of the heats were promising enough to warrant further exploration of the method. (auth)

4839 WADC-TR-54-112(Pt. II)

Michigan. Univ., Ann Arbor. Engineering Research Inst.

INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM-BASE ALLOYS. PART II. INFLUENCE OF MICROSTRUCTURES ON CREEP-RUPTURE PROPERTIES. [Period covered] October 1, 1953 to February 28, 1955. Jeremy V. Gluck and James W. Freeman. Sept. 6, 1957. 148p. Project title: METALLIC MATERIALS. Task title: TITANIUM METALS AND ALLOYS. Contract AF33(616)-244. (AD-142198).

An investigation was carried out to establish the relationships between types of microstructure and creep-rupture properties of Ti alloys at 600 to 1000°F. Chemical composition and the influence of heat treatment were investigated to a limited extent for each type of alloy. The data are fairly complete for some alloys and consist of survey test data for others. Alpha Ti as represented by commercially pure Ti had the lowest strength. Stable alpha alloys (6% Al and 6% Al–0.5% Si) and stable beta alloys (30% Mo and 50% V) had similar strengths. These alloys had the highest strength at 800 and 1000°F where creep was a major factor. The alpha-beta alloys (Ti 150A and Ti 155AX) and the meta-stable beta alloys had high strengths through 600°F and for short time periods at 800°F by virtue of strengthening from transition structures from the beta to alpha transformation. Compositional differences between alloys had rather small effects in most cases. Properties of the alpha-beta and meta-stable beta alloys were markedly influenced by heat treatment except at 1000°F. The other structures were little influenced by heat treatment. Ductility varied considerably between alloys and with heat treatment and test conditions. None of the alloys were subject to appreciable creep at 600°F and strength was governed by tensile properties for time periods up to 1000 hr. Increasing tensile strength by cold work or by heat treatment permitted application of high stresses which usually caused immediate failure at 600°F when the stress was above the yield strength. This seemed to be a delayed tensile fracture rather than true creep to rupture. Creep and structural stability were the major factors in strength at 800 and 1000°F. (auth)

4840 WADC-TR-57-405

Dow Chemical Co., Midland, Mich.

THE MECHANISM AND KINETICS OF AGE HARDENING IN Mg–Li ALLOY SYSTEMS. Period Covered: November 1955 to March 1957. J. B. Clark. Aug. 1, 1957. 53p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: INTERACTIONS, IMPERFECTIONS, AND ALLOY THEORY. Contract AF33(616)-3177. (AD-142107).

The habit plane of a Widmanstätten precipitate of the LiZn phase in the cubic Li–Mg solid solution of a 5 at. % Li, 45 at. % Mg, 50 at. % Li is the (100) plane of the matrix. The precipitation of the MgLiZn phase in the cubic Li–Mg solid solution is a two step process as follows:

$\beta \rightarrow \theta \longrightarrow MgLiZn$, where β = cubic lithium solid solution matrix, θ = transition structure $MgLi_2Zn$, $\rightarrow$ = precipitation. The lattice of the transition structure (θ) was parallel to the lattice of the matrix (β) but the equilibrium precipitate MgLiZn takes the following orientation:

$(110)_\beta$ || (111) MgLiZn and $[110]_\beta$ || [112] MgLiZn. Debye-Scherrer, metallographic, and mechanical property studies were made on a series of Mg–Li–Al–In and Mg–Li–Zn–In alloys to ascertain whether the large disregistry between the matrix and the age hardening precipitates in Mg–Li–Zn and Mg–Li–Al alloys could be reduced by addition of indium. Little reduction in disregistry was observed and the alloys exhibited no properties of commercial significance. (auth)

4841 WADC-TR-57-518

Dow Chemical Co., [Midland, Mich.].

DETERMINATION OF THE FORGING CHARACTERISTICS OF NEW AND HIGH TEMPERATURE MAGNESIUM ALLOYS. [Period covered] April 1, 1956 to June 15, 1957. R. E. Hook and J. F. Pashak. June 1, 1957. 120p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-3578. (AD-142197).

This laboratory forging program was established for the purpose of selecting the best Mg alloy or alloys for elevated temperature service. The alloys investigated were three Mg–Th alloys (HM21XA, HK31A, HZ32A) and four Mg–RE alloys (EK31(MM), EZ33A, EK31(Di), EM41XA); two commercial alloys (AZ80A, ZK60A) were included for comparative purposes. Both cast ingot and extruded billet were used as forging stock. Static properties and creep resistance of the alloys were determined on forged discs of 90% reduction. The data, therefore, cannot be considered as representative of die forgings. Of the alloys investigated, HM21XA-T5 exhibits the best combination of properties in the range of 500 to 700°F while EK31XA-T6 presents the optimum values at 70 to 500°F. Pre-forging cast ingot has no significant effect on the properties of forgings when the final forging reduction is as great as 75%; however, increasing preforging temperature has a deleterious effect on the final forged properties. Evaluation of closed die forgings produced on a 3000 ton press show that ease of forging (die filling) increases in the following order: HM21XA, HK31A, EK31(Di), commercial alloy AZ80A and ZK60A. Temperature and pressure requirements to fill the die for a given alloy increase as the draft angle (7°, 3°, 0°) decreases. (auth)

4842 WADC-TR-57-648

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF OXIDATION AND LIQUID SODIUM RESISTANT BRAZING ALLOYS. Domenic A. Canonico and Harry Schwartzbart. Sept. 13, 1957. 47p. Project title: MATERIALS FOR P AND W SUBSYSTEMS. Task title: P AND W ANP MATERIALS. Contract AF33(600)-33406.

The first year's work has been completed at Armour Research Foundation on a program which has as its objectives: (1) the development of filler metals for brazing type 310 stainless steel to Inconel, the brazements to be resistant to oxidation and attack by molten sodium at 1650°F, and (2) the development of a simple test for the ductility of a brazed joint. Three metals—iron, chromium, and nickel—were selected, from oxidation and sodium resistance considerations, as the base metals from which to develop acceptable brazing alloys. From a study of all the available pertinent phase diagrams 91 alloys were devised, of which 16 satisfied the flow temperature and flowability requirements of the program. The flow temperature was between 1750 and 1900°F. Minimum flowability was three inches of length along a six-inch T-specimen. T-specimens brazed with these 16 alloys were subjected to an oxidizing atmosphere for 500 hours at 1650°F. Four alloys successfully withstood oxidation to a depth of less than 0.003 inch. A test for ductility of brazed joints, based on the premise that the load necessary to cause cracking in the fillet of a braze is a measure of the ductility of the brazing alloy, has been developed. The test has shown itself to be capable of differentiating two filler alloys, although the large amount of scatter obtained required that a statistical analysis of the data be applied. Further development should reduce the scatter. (auth)

4843 AEC-tr-3132

ELECTROLYTIC PROCESSES FOR THE PREPARATION OF PURE METAL FROM ORE AND CRUDE METAL. Gunther Hansel. Translated by Alfred L. Monks from Elektrotech. Z. 64, 579-84(1943). 17p.

The technical production of pure metal by electrolysis of molten salts, solutions, and scrap and waste products is surveyed. The purity obtainable by electrolytic means aids in improving mechanical properties and providing new uses of the metal. (L.M.T.)

4844 AEC-tr-3133

CERTAIN PROPERTIES OF Zr–Nb ALLOYS. In. F. Bychkov, A. N. Rozanov, and D. M. Skorov. Translated from Atomnaya Energ. 2, 146-51(1957).

A phase diagram of the Zr–Nb system constructed from experimental data is presented. Results are given of the expansion of Zr–Nb alloys at room temperature and an estimate of their hot strength from hardness measurements at temperatures up to 750°C, and a measurement of the hardness of alloys resulting from low temperature annealing (aging) is also given. The data obtained are explained using the phase diagram. The heat resistance of alloys oxidized in the air at 570° and 650°C is determined. (auth)

4845 AEC-tr-3137

NORMAL ELASTIC MODULUS OF Zr–Nb ALLOYS. Yu. F. Bychkov, A. N. Rozanov, and D. M. Skorov. Translated from Atomnaya Energ. 2, 152-6(1957). 7p.

4846

HYDROGEN DISTRIBUTION IN HEAT-TREATED TITANIUM AS ESTABLISHED BY AUTORADIOGRAPHY. O. J. Huber, J. E. Gates, A. P. Young, M. Pobereskin, and P. D. Frost (Battelle Memorial Inst., Columbus, Ohio). J. Metals 9, 918-23(1957) July.

The duplex heat treatment of the two phase titanium alloys containing relatively large amounts of β-stabilizing elements frequently produces a dark-etching phase at the grain boundaries. An investigation of this phase was conducted on an alloy containing Ti–3% Mn–1% Cr–1% Mo–1% V in the annealed and in the heat-treated condition. Autoradiography, using tritium as a tracer element, and electron microscopy showed the intergranular phase to be a hydrogen-rich material. (auth)

4847

ULTRASONIC SOLDERING, BRAZING AND WELDING. J. Byron Jones and William C. Potthoff (Aeroprojects Inc., West Chester, Penna.). Prod. Eng. 28, No. 15, g14-g16 (1957). Mid.-Oct.

Eliminating the need for flux and its attendant problems in ultrasonic soldering and brazing improved joint reliability and reduced production costs. Ultrasonic welding facilitates the joining of similar or dissimilar metals that are normally difficult or impossible to join by conventional methods. (auth)

4848

INFLUENCE OF VARIOUS GRINDING CONDITIONS UPON RESIDUAL STRESSES IN TITANIUM. P. A. Clorite and E. C. Reed (Pratt & Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.). Trans. Am. Soc. Mech. Engrs. 80, 297-301(1958) Feb.

Grinding conditions may be expected to affect residual

surface stresses from any particular grinding operation. Stresses were measured in titanium test bars, surface-ground with various wheels, speeds, grinding fluids, down-feeds, and crossfeeds. Results suggest that, with suitable precautions, titanium alloys may be ground under either "near-normal" or "low-speed" conditions with acceptable grinding ratios and with low residual stresses. (auth)

4849

THE TIME AND TEMPERATURE DEPENDENCE OF THERMAL STRESSES IN CYLINDRICAL REACTOR FUEL ELEMENTS. K. R. Merckx (General Electric Co., Hanford Wash.). Trans. Am. Soc. Mech. Engrs. 80, 505-9 (1958) Feb.

A method of calculating the thermal stresses in cylindrical shapes is developed in this paper which uses a material model relating strain rate, temperature, strain, and stress. The material model, evaluated for unirradiated uranium, is used with this method to obtain the build-up and decay of the thermal stresses and strains in a solid-uranium fuel element operating in the temperature ranges of 100 to 350°C and 350 to 600°C during a 25-min. period of increasing power generation and 700-min. period of steady-state operation. During the period of increasing power generation, the elastic surface stresses are predicted to relax 60% for the 100 to 350°C example and 48% for the 350 to 600°C example. Further relaxation of 11.5% for the 100 to 350°C case and 40% for the 350 to 600°C case is calculated during the period of steady-state power generation. (auth)

4850

A STUDY OF METALLURGICAL EFFECTS IN THE MULTIPASS WELDING OF ZIRCALOY. R. E. Johnson and B. W. Schaaf (Westinghouse Electric Corp., Pittsburgh). Welding J. (N. Y.) 37, 1s-9s(1958) Jan.

From an engineering point of view, high-quality multipass welds are being made in Zircaloy. In confirmation of this, a 32-pass weldment was made and tested. These tests indicate that 100% joint efficiency was achieved with very slight loss of ductility through proper control of interpass temperature. Generally speaking, the corrosion behavior of the weldment is equivalent to, or better than, that of the base metal. Hot-rolled plates of Zircaloy-2 and Zircaloy-3 were subjected to welding, then heat treated to exaggerate recognized embrittling phenomena and tested. These deleterious heat treatments caused property changes which appear to be worthy of consideration. It must be emphasized, however, that the metallurgical effects of these treatments are not the same as those produced by actual multipass-weld thermal cycles as has been postulated by other experimenters. The study of embrittlement of individual welds by furnace heat treatment has only pointed out the active variables; more work will be necessary to determine the degree of importance, if any, of such variables in multipass welding. (auth)

4851

SYMPOSIUM ON POWDER METALLURGY, 1954. Special Report No. 58. London, The Iron and Steel Institute, 1956. 399p.

The papers presented at the symposium on powder metallurgy held in London, December 1 and 2, 1954, are presented in this volume. (W.L.H.)

PHYSICS

4852 AD-131788

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

DETERMINATION OF THERMAL EXPANSIVITY OF ZIRCONIUM HYDRIDE (thesis). Russel Riegel Rentschler. Mar. 1957. 48p.

This report recounts the unique features of ZrH_4 which were considered. How a dilatometer was designed, calibrated, and used to determine the thermal expansivity of several sample hydrides of Zr are reported. Only one sample of each hydride was tested. However, experimental results indicate that the thermal expansivity of hydrides of Zr increases with increasing H_2 content. Another interesting development was that subsequent experimental runs on the same ZrH_4 sample indicated an increasingly greater thermal expansion. The explanation for this phenomenon is not certain but is believed to be either an annealing effect or possibly a result of contamination from dilatometer outgassing, probably a combination of both. (auth)

4853 AECU-3572

Syracuse Univ., N. Y. Research Inst.

TRANSIENT LOADING OF THIN-WALLED CYLINDERS. Interim Technical Report. Stanley Anthony Mosier. Aug. 2, 1957. 138p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-577T). $21.30(ph OTS); $6.90(mf OTS).

The effect of internal static loading and internal transient loading on the deformation of thin-walled tube specimens was studied for both the elastic and plastic regions. The specimens employed were six inch sections of type 304, seamless, stainless steel tubing having a nominal O.D. and wall thickness of 3/4 inch and 0.020 inch, respectively. The transient forces were obtained from detonations of stoichiometric hydrogen-oxygen mixtures contained in a shock-type detonation tube. Each specimen was postfixed to the detonation tube and then acted as an extension of the tube. The detonation wave travelled through the system and exerted on the specimen walls a strain from either a single incident wave pressure or from an incident plus reflected wave pressure combination, depending upon the apparatus used to cap the downstream end of the specimen. Strains in the elastic region were measured with bonded electric resistance strain gages, while strains in the post-yield region were measured with a micrometer. The static loading forces were obtained from high pressure oil fed from a hydraulic pump into the specimen. The Young's Modulus of Elasticity for transient loading was 1.22 times greater than for static loading. Similarly, the 0.2 percent offset yield strength for the incident detonation wave transient loading case and for the incident plus reflected detonation wave transient loading case were 1.41 and 1.50, respectively, times the static yield strength. The results of this investigation indicated that as the time of force application decreased, the ability of type 304 stainless steel to resist deformation increased. In other words, the specimen exhibited a much higher value of toughness, elastic resilience and hyper-elastic resilience when loaded by a transient force than when loaded statically. (auth)

4854 ISC-899

Ames Lab., Ames, Iowa.

ELECTRONIC SPECIFIC HEAT OF SODIUM TUNGSTEN BRONZE. Robert W. Vest, M. Griffel, and J. F. Smith. Mar. 1957. 75p. Contract W-7405-eng-82. $2.00(OTS).

The design and operation of a calorimeter for use in the temperature range 1.8 to 4.2°K are presented, and the methods used in the treatment of data and calculation of results are discussed. The heat capacities of several Na–W bronzes (Na_xWO_3) were determined in the temperature interval 1.8 to 4.2°K. Samples having x equal to 0.99, 0.81, 0.73, 0.65, and 0.56 were studied. The measured heat capacities are described adequately by the sum of two terms, one linear and one cubic in temperature. The electronic specific heat of each sample is obtained by evaluat-

ing the coefficient of the linear term, and the Debye characteristic temperature derived from the coefficient of the cubic term. Densities of one-electron energy levels at the Fermi energy, and effective electronic masses are calculated from the electronic specific heats. A plot of the density of states as a function of energy can be made if it is assumed that this curve is independent of Na concentration. The justification of this assumption is discussed in the light of current theories of the solid state. The density of states curve rises rapidly at higher energies, and this rise is interpreted in terms of the filling of a Brillouin zone or of an overlap of two bands. (auth)

4855 NP-6544

New York Univ., New York.

RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 2 [for] May, June, July [1957]. Hartmut Kallmann. Oct. 1957. 110p. Contract DA-36-039-sc-73145.

Progress is reported on the fluorescence of solutions with two solutes and on electroluminescence and electrophotoluminescence. (For preceding period see NP-6442.) (J.E.D.)

4856 NP-6548

MSA Research Corp., Callery, Penna.

PROGRESS REPORT NO. 43 FOR OCTOBER AND NOVEMBER 1957. W. J. Posey, ed. Dec. 16, 1957. 24p. Contract NObs-65426.

Progress is reported on the A1W hydrodynamic test program, film boiling with water inside tube, simulation of vapor container venting under sea water, chromate formation in high-temperature water systems, fission product release during core meltdown simulation, and radioactivity associated with crud particle size ranges. (For preceding period see NP-6480.) (W.L.H.)

4857 NP-6556

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 27. Jan. 15, 1958. 63p. Contract Nonr-1841(34).

The average energies of configurations of atoms and ions of Sc, Ti, Fe, and Ni are calculated. Results of atomic calculations for Fe and Ni are plotted and tabulated, including 3d wave functions, basic wave function parameters, total atomic energy, one and two electron energies, and energy splittings. Electron population analysis and dipole moments for HF and LiH are presented. Electronic wave functions for HF molecule and electron coupled interaction between nuclear spins in the HD molecule are calculated. Results for density of states and x-ray emission of KCl and energy bands in potassium are reported. (For preceding period see NP-6441.) (M.H.R.)

4858 AEC-tr-3105

ENERGY-TRANSFERENCE PROCESSES IN LUMINESCENCE. Wilhelm Hanle. Translated from Physik. Bl. 10, 565-77(1954). 16p.

Energy may be supplied by the absorption of light or by bombardment with charged particles. It is often transferred from the absorption point to other points. Luminescence, i.e., emission of light by individual "excited" atoms, molecules, or molecular complexes, is often the final phase of an energy-absorption and transference process. A study of this phenomenon yields insight into the nature of energy transference processes in the atomic domain. As the ultimate phase of the entire process, luminescence may be accompanied or replaced by ionization, chemical changes, or conversion into thermal energy. (A.C.)

4859 AEC-tr-3118

A NEW METHOD FOR MEASURING CONDUCTIVITY WITHOUT ELECTRODES. Werner Braunbek. Translated from Z. Physik 73, 312-34(1931). 17p.

An electrode-less method is described for relative measurements of the conductivity of metals and alloys, especially in the liquid state. It rests upon measuring the torque exerted on a probe in a rotating magnetic field because of eddy currents. The utility of the method is demonstrated with two examples: The conductivity of copper to 400°C and of mercury to 400°C. Errors can be held below ½% with this method. (auth)

4860 AEC-tr-3119

CHANGE OF ELECTRICAL CONDUCTIVITY OF MOLTEN BISMUTH UPON SOLUTION OF BISMUTH CHLORIDE. Werner Braunbeck. Translated from Z. Physik 73, 335-47 (1931). 4p.

The method described in AEC-tr-3118 (see preceding abstract) was used to measure the conductivity of Bi–$BiCl_3$ mixtures in order to test the effect of a dissolved non-metal which is not an electronic conductor. The electrical conductivity of liquid solutions of $BiCl_3$ in Bi drops fairly uniformly with increasing Cl content. Quantitatively, the effect on the conductivity is surprisingly small, even at 7.5 mol. % Cl the conductivity being not quite half. Thus the metallic concentration of the solution is maintained to high concentrations of Cl. (L.M.T.)

4861 AEC-tr-3125

SCIENTIFIC PRINCIPLES IN THE PRODUCTION OF METALLIC TUNGSTEN FOR THE ELECTRIC-LAMP INDUSTRY AND THE CONTROL OF ITS CHARACTERISTICS. T. Millner. Translated from Acta Tech. Acad. Sci. Hung. 17, 67-112(1957). 47p.

A rather extensive discussion is presented of the basic metallurgy of tungsten, with emphasis on recent research (much hitherto unpublished). 61 References. (L.M.T.)

4862 AEC-tr-3136

DEPENDENCE OF PLASTICITY OF ROCK SALT ON THE SURROUNDING MEDIUM. K. Kleinhanns. Translated from Physik. Z. 15, 362-3(1914). 3p.

4863

CROSS SECTIONS FOR BREMSSTRAHLUNG AND PAIR CREATION INVOLVING POLARIZED ELECTRONS AND PHOTONS. Arne Claesson (Univ. of Lund, Sweden). Arkiv Fysik 12, 569-89(1957).

The differential cross sections for bremsstrahlung and pair creation involving arbitrarily polarized electrons and linearly and circularly polarized photons are computed. Numerical calculations are made and the cross sections are determined as functions of the angle between the scattering planes for circularly polarized photons, definite scattering angles and for four different energies and nine combinations of the polarization directions of the electrons as this is enough to determine the cross sections for arbitrarily polarized electrons. From the curves thus obtained the maximum value of the cross sections are plotted as function of the energy of the incoming particle. (auth)

4864

MEASUREMENT OF MAGNETIC FIELD GRADIENTS BY THE HALL EFFECT. R. D. Redin and G. C. Danielson (Iowa State Coll., Ames). Iowa State Coll. J. Sci. 32, 463-9(1958) Feb. 15.

A magnetic field gradient measuring device which uses the Hall effect in germanium has been constructed. The field sensitive element was a bar of germanium 1 mm by 1 mm by 12 mm with two sets of Hall leads each attached 2 mm from the center of the bar. With 100 cps current flowing in the long direction of the bar, the two Hall voltages

were subtracted to give an output directly proportional to the magnetic field gradient. The instrument was tested in a calculable magnetic field produced by step pole pieces, and gradients from 5 gauss/inch to 500 gauss/inch in magnetic fields below 5000 gauss were measured. The instrument will also measure magnetic field strengths and relative gradients. The usefulness of the instrument is still uncertain because of errors caused by excessive field dependence of the gradient voltage. (auth)

4865

THE CALCULATION OF THE AGE OF THE ELEMENTS. A. H. W. Aten, Jr. Physica 23, 1073-86(1957) Dec.

It is shown that if the known abundance ratio of thorium and uranium is taken into account, a fairly accurate value can be derived for the age of the elements, even with the existing uncertainty in the dependence of primary stabilized abundances on the atomic weight and in the abundances of the heaviest isotopes of thorium and uranium. The age of the elements turns out to be $6.25 \times 10^9 \pm 0.5 \times 10^9$ years. (auth)

4866

TEMPERATURE DEPENDENCE OF THE MAGNETIC SUSCEPTIBILITY OF α-SILVER–ZINC ALLOYS. Lothar Meyer and Dan Weiner (Univ. of Chicago, Ill.). Phys. Rev. 108, 1426-7(1957) Dec. 15.

The magnetic susceptibility of α-silver–zinc alloys has been measured from 5 to 35% Zn between room temperature and helium temperatures. All samples became slightly more diamagnetic with decreasing temperature, and any temperature-dependent paramagnetic contribution to the susceptibility due to bound electron states must be less than 0.1% of the room-temperature value of the susceptibility. (auth)

4867

CARRIER ACCUMULATION IN GERMANIUM. J. B. Arthur, A. F. Gibson, and J. B. Gunn (Radar Research Establishment, Malvern, Worcs.). Proc. Phys. Soc. (London) B69, 697-704(1956).

Contacts can be made to germanium crystals which are largely impermeable to minority carriers but permeable to majority carriers. In the presence of a suitable electric field high concentrations of minority carriers can accumulate at such contacts. It is the purpose of this paper to describe some experiments which demonstrate the existence of this effect. (auth)

4868

CURRENT GAIN AT L-H JUNCTIONS IN GERMANIUM. J. B. Arthur, A. F. Gibson, and J. B. Gunn (Radar Research Establishment, Malvern, Worcs). Proc. Phys. Soc. (London) B69, 705-11(1956).

Junctions between lightly and heavily doped germanium of the same conductivity type (L-H junctions) have a low leakage velocity for minority carriers. This result can be considered as a reduction of the minority carrier mobility and gives rise to enhanced current gain in certain structures, for example filamentary transistors. The paper describes experiments designed to demonstrate the existence of this effect and to indicate its magnitude. (auth)

4869

EQUILIBRIUM SPECTRUM OF ELECTRONS AND PHOTONS WITH ACCOUNT OF SCATTERING. I. P. Ivanenko (Moscow State Univ.). Soviet Phys. JETP 5, 204-8(1957) Sept.

An exact solution of the equation for the equilibrium spectrum of electrons and photons has been found with account of scattering, i.e., an expression is obtained for the angular and energetic distributions of particles at the shower maximum in heavy elements. (auth)

4870

FISSION OF U, Th, Bi AND Tl INDUCED BY HIGH ENERGY γ-QUANTA. E. V. Minarik and V. A. Novikov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 253-7(1957) Sept.

The photofission yields of U^{238}, Th^{232}, Bi^{209}, and $Tl^{204,206}$ have been measured with an ionization chamber at bremsstrahlung maximum energies from 80 to 250 Mev. The photofission effective cross sections computed by the total spectrum method rapidly increase from ~ 80 Mev and at 250 Mev reach a value of (220 ± 80) mb for U, (80 ± 30) mb for Th, (4.7 ± 0.6) mb for Bi, and (1.6 ± 0.2) mb for Tl. The energy dependence of the cross sections is the same for all four elements and, above 150 Mev, is similar to the energy dependence of the total cross section for photoproduction of neutral and charged mesons. (auth)

4871

DIFFRACTIVE PRODUCTION OF PROTON-ANTIPROTON PAIRS BY HIGH ENERGY PHOTONS. A. G. Sitenko and L. N. Rosentsveig (Ukrainian Academy of Sciences). Soviet Phys. JETP 5, 330-1(1957) Sept.

4872

POSSIBLE PROPERTIES OF THE NEUTRINO SPIN. L. D. Landau (Academy of Sciences, USSR). Soviet Phys. JETP 5, 337-8(1957) Sept.

4873

CONCERNING A POSSIBLE METHOD FOR THE POLARIZATION OF A PROTON BEAM. E. K. Zavoiskii. Soviet Phys. JETP 5, 338-9(1957) Sept.

4874

OSCILLATIONS OF A FERMI-LIQUID IN A MAGNETIC FIELD. V. P. Silin (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1227-34(1957) Nov. (In Russian)

Spin oscillations of a paramagnetic Fermi-liquid (He^3) placed in a constant magnetic field are considered at low temperatures when it is possible to disregard collisions. (tr-auth)

Aerosols

4875 NARF-57-56T

Convair, Fort Worth, Tex.

AERIAL SAMPLING OF EFFLUENT FROM WASTE FIRES. H. G. Bradbury and M. J. Young. Dec. 15, 1957. 36p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-188).

An airborne sampling device was modified and tested. This device makes it possible to obtain representative samples of air and particulate matter at altitudes up to 1000 feet and in winds up to 25 mph. The sampling apparatus consists of two model airplane engines which draw air through filters for continuous sampling of particulate matter; and two one-gallon jugs containing balloons which, by deflation, take volumetric samples of air. The sampling apparatus is carried aloft by means of a helium-filled kite balloon. The equipment is used to obtain samples of effluent from waste fires for use in diffusion studies. (auth)

Cosmic Radiation

4876

EFFECTIVE MAGNETIC MERIDIAN FOR COSMIC RAYS. J. R. Storey, A. G. Fenton, and K. G. McCracken (Univ. of Tasmania, Hobart). Nature 181, 34(1958) Jan. 4.

An investigation was made on the cosmic-ray meridian

through Melbourne by counting the disintegration-product neutrons from the local production stars in lead. The monitor used consisted of two counters installed in an aircraft. The cosmic-ray meridian was determined by flying the aircraft in a triangular circuit with a vortex at Melbourne and the base to the north. Since the difference between the declination and the geomagnetic meridian does not exceed 2° at any location in Australia, the results were inconclusive. (C.H.)

4877

POLARIZATION OF COSMIC-RAY μ MESONS: THEORY. Satio Hayakawa (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1533-7(1957) Dec. 15

The expected polarization of cosmic-ray μ mesons is calculated on the basis of the two-component theory of the neutrino. The polarization is found to reveal the energy spectrum of π mesons which decay into μ-mesons at high altitudes, provided that the depolarization on penetration through the atmosphere is known. The depolarization caused by the Coulomb scattering is estimated to be several percent and practically independent of the energy of μ mesons at production. The depolarization in the absorber is found to be negligible. (auth)

4878

POLARIZATION OF COSMIC-RAY μ MESONS: EXPERIMENT. George W. Clark and Juan Hersil (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1538-44(1957) Dec. 15.

This paper describes an experimental determination of the polarization of low-energy cosmic-ray μ mesons at sea level. A brass plate was placed in a horizontal position inside a magnetic solenoid. Particles which arrived from directions near the vertical and stopped in the plate were detected by a coincidence-anticoincidence counter telescope. Stopped negative μ mesons were destroyed by nuclear capture. Stopped positive μ mesons decayed into electrons which were detected by delayed coincidence counters placed above and below the plate. The upward and downward fluxes of the decay electrons leaving the absorber were measured alternately with and without a depolarizing magnetic field. The results of the measurements demonstrate that (1) cosmic-ray μ mesons are polarized, (2) the ratio between the downward fluxes of electrons from the decay of μ mesons stopped in a brass plate with and without a depolarizing magnetic field is 1.052 ± 0.016, and (3) the indicated polarization of stopped positive μ mesons is 0.19 ± 0.06 if the data are interpreted according to the two-component neutrino theory of μ-meson decay. The results are consistent with theoretical predictions based on the production spectrum of π mesons as found in other experiments. (auth)

4879

INITIAL STAGES IN THE PROPAGATION OF COSMIC RAYS PRODUCED BY SOLAR FLARES. R. Lüst and J. A. Simpson (Univ. of Chicago, Ill.). Phys. Rev. 108, 1563-76 (1957) Dec. 15.

The propagation of solar cosmic rays produced in the February 23, 1956 flare has been studied from the time they leave the flare region to the time when the terrestrial cosmic-ray intensity reaches a maximum value. Within this interval there are observed not only strong anisotropies in the incident radiation, but also relatively large differences in time (≤9 minutes) between the commencements of the intensity increases in different parts of the world. This distribution of time delays is superposed upon the transit-time delay which all particles experience between production and detection. From these experimental results, and the calculations of orbits connecting the sun and earth at the time of the flare, it is shown that there are broad impact zones on the earth within the first ten minutes of the cosmic-ray intensity increases. Using the recently deduced flare-particle spectrum, cosmic-ray intensities at the top of the atmosphere have been determined for the different impact zones. For this flare event the "2000 hour" impact zone becomes as important as the "0900" and "0300" hour impact zones. These results demonstrate that the first flare particles arriving at the earth were not of low energy, and that the low-energy particles arrived later—the delay being an inverse function of energy. This energy-dependent spread of first arriving particles is called the dispersion effect arising from the mode of particle propagation from the flare source to the earth. These conclusions show that back scattering from disordered magnetic fields beyond the orbit of the earth does not account for the time delays. Various alternatives are considered for production of this distribution of onset times. The most likely process appears to be propagation through magnetic fields by diffusion. Since the impact-zone data for all geomagnetic latitudes, including both polar regions, predict a distant source in the direction of the sun but of order one radian solid angle in the sky, and since sufficient diffusion around the earth to produce the required time delays would destroy the observed impact-zone effects, it is suggested that there may exist a diffusing envelope around the sun which accounts for both the apparent source size and the dispersion effect. Small irregularities in the general solar dipole field are invoked to produce the diffusion. Calculations show that the predicted dispersion effect agrees with the observations, and that other details following from diffusion are satisfied. There is evidence of a dispersion effect for the flare particles of November 19, 1949. The implications of these results for possible uniform magnetic-field distributions between the sun and earth are reviewed, and it is shown from the orbit calculations and the dispersion effect that the predictions are not in agreement with observations. There is a transition period between the time when impact zones are dominant and the time when isotropy sets in. The subsequent storage of the solar cosmic-ray particles is not further considered in this paper, except for the bearing of these observations at early times upon the character of the interplanetary storage magnetic fields. (auth)

4880

STRUCTURE OF THE PERIPHERY OF EXTENSIVE ATMOSPHERIC COSMIC RAY SHOWERS. Iu. N. Antonov, Iu. N. Vavilov, G. T. Zatsepin, A. A. Kutuzov, Iu. V. Skvortsov, and G. B. Khristiansen (Academy of Sciences, USSR). Soviet Phys. JETP 5, 172-83(1957) Sept.

An investigation of the lateral distribution of various components of extensive showers at their periphery (200 to 800 m from the axis) has been carried out. The data on the lateral distribution indicate that the contribution of the shower periphery to the total shower particle flux is significant. The lateral distribution of the electron component at the periphery can be explained by means of the theory of multiple Coulomb scattering. Coulomb scattering also plays an important role in the divergence of the penetrating particles (μ mesons); however the angles of emission in the elementary events of nuclear cascade processes of $\pi^{\pm}$ mesons which give rise to μ mesons can apparently also lead to this type of divergence of μ mesons. An investigation of the intensity of the primary cosmic radiation at very high energies (10^{16} to 10^{17} ev) was also carried out. (auth)

4881

ALTITUDE DEPENDENCE OF BROAD ATMOSPHERIC SHOWERS ACCORDING TO THE VARIOUS MODELS OF THE ELEMENTARY ACT OF NUCLEAR COLLISIONS. V. V. Guzhavin and G. T. Zatsepin (Academy of Sciences, USSR). Soviet Phys. JETP 5, 312-13(1957) Sept.

Calculations were carried out for two variants of nuclear collision models. The summation of electron-photon showers arising from π^0 mesons is carried out graphically. The results of the computation are tabulated. The results of the calculations of the number of electrons at mountain top elevation and sea level are shown in the table. The computed and experimental altitude dependence are only in fair agreement. (A.C.)

4882

INELASTIC INTERACTION OF PROTONS WITH ENERGIES GREATER THAN 7 Bev WITH CARBON AND HYDROGEN NUCLEI. K. I. Alekseeva and N. L. Grigorov (Moscow State Univ.). Soviet Phys. JETP 5, 339-40(1957) Sept.

4883

THE SPATIAL DISTRIBUTION OF THE PENETRATING COMPONENT OF WIDE ATMOSPHERIC SHOWERS. E. L. Andronikashvili and M. F. Bibilashvili (Academy of Sciences, Georgia SSR). Soviet Phys. JETP 5, 341-2(1957) Sept.

Studies were carried out on the spatial distribution of the penetrating component of wide atmospheric showers at an altitude of 400 m above sea level in a tunnel underneath 26.6 m of earth. The measurements of the density of penetrating particles were carried out at various distances from a vertical axis passing through the center of the detecting system. Data were obtained on the spatial distribution of the penetrating component of showers. These data are tabulated. (A.C.)

4884

INTERACTION OF PARTICLES OF ENERGY 10^{12} TO 10^{13} ev WITH LIGHT ATOMIC NUCLEI. N. L. Grigorov, V. Ya. Shestoperov, V. A. Sobinyakov, and A. V. Podgurskaya (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1099-1109(1957) Nov. (In Russian)

A study was made of the spectrum of big ionization bursts in 44 ionization chambers covered with a layer of lead of thickness 10 and 12 cm at an altitude of 3200 m above sea level. Conclusions are drawn from the probability of observation of bursts accompanied by air showers, concerning a range of particles of energy ~ 10^{12} ev for interaction in air. There were cases of the simultaneous appearance of two and more bursts of commensurable magnitude in several ionization chambers separated from each other (bursts with spatial structure). (tr-auth)

4885

THE ANGULAR DISTRIBUTION OF THE AXES OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. A. T. Abrosimov, V. I. Gomankov, I. A. Ivanovskaya, and L. I. Sarycheva (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1110-15(1957) Nov. (In Russian)

A cloud-chamber study was made of the angular distribution of the axes of extensive air showers at sea level. In approximating the angular distribution by the $\cos^n \theta$ type relation, the exponent $n = 8.3 \pm 1.4$. (tr-auth)

4886

A STUDY OF SLOW μ-MESONS IN THE STRATOSPHERE BY THE METHOD OF DELAYED COINCIDENCES. V. F. Tulinov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1163-5(1957) Nov. (In Russian)

A study was made of the altitude dependence of μ mesons of energy ~ 100 Mev up to altitudes of about 25 km at 51 and 31° north latitude. The spectra of meson generation in the atmosphere at the stated altitudes were found. (tr-auth)

4887

ELECTRON SPECTRUM AT 3200 m ABOVE SEA LEVEL. M. I. Daion (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1166-74(1957) Nov. (In Russian)

Using a magnetic spectrometer articulated with a multiplate cloud chamber, a momentum spectrum was obtained of cosmic-radiation electrons in the momentum interval from 4×10^8 to 4×10^9 ev/c. The problem of the penetrability of fast electrons ($E \geq 4 \times 10^8$ ev) is considered. (tr-auth)

4888

EXPERIMENTAL DATA ON THE CASCADE MULTIPLICATION OF ELECTRONS IN LEAD. M. I. Daion (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1175-8 (1957) Nov. (In Russian)

Experimental data have been obtained concerning the number of secondary electrons at depths of 1.4; 2.8; 4.2 t units (Pb) for the primary electrons energies of 200 to 500 Mev. A comparison is made with theoretical calculations carried out by the Monte Carlo method. (tr-auth)

Electrical Discharge

4889 AECU-3616

Los Alamos Scientific Lab., N. Mex. and Yale Univ., New Haven. Sterling Chemistry Lab.

DEBYE-HÜCKEL, THOMAS-FERMI THEORY OF PLASMAS AND LIQUID METALS: NUMERICAL SOLUTION. Robert D. Cowan and John G. Kirkwood. [1957]. 36p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

A Debye-Hückel-type theory is described for an assembly of completely ionized atoms, the nuclei being treated classically and the electrons by the Thomas-Fermi method. The thermodynamic functions are derived by considering the Debye charging process, and the virial theorem is shown to hold. Numerical results are given for hydrogen and iron near normal solid densities, and are probably accurate only at high temperatures ($kT > 5$ ev for hydrogen and $kT > 100$ ev for iron). (auth)

4890 AERE-T/R-1888

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HYDROMAGNETIC INSTABILITIES OF A CYLINDRICAL GAS DISCHARGE. PART 2. INFLUENCE OF VISCOSITY. R. J. Tayler. May 1956. Decl. Sept. 6, 1957. 40p.

In a previous report hydromagnetic instabilities of an inviscid perfectly conducting plasma were considered. The results obtained were a generalization of those previously found by Kruskal and Schwarzschild, and in common with these they predicted that disturbances of the shortest wavelength were intrinsically the most unstable. This cannot be true in the presence of viscosity because of the large viscous stresses which would be called into play, and this report demonstrates the existence of a mode of maximum instability and obtains a first approximation to the value of the corresponding wave number. (auth)

4891

THE ACCELERATION OF A PLASMA BY A MAGNETIC FIELD. A. I. Morozov (Moscow State Univ.). Soviet Phys. JETP 5, 215-20(1957) Sept.

Acceleration of a current-conducting plasma jet by a magnetic field is considered. The nature of the processes is preliminarily elucidated by examining the case of motion of conductors possessing some resistance and inductance. Furthermore, the motion of ions and electrons is studied under conditions where collisions, magnetic interaction of the particles and excitation of waves are negligible. The existence of a critical charge density in accelerators has been established for this case. Peculiarities of acceleration of very dense jets are also considered. (auth)

Electrons

4892
BEHAVIOR OF AN ELECTRON IN A PERIODIC ELECTRIC AND A UNIFORM MAGNETIC FIELD. G. E. Zil'berman. Soviet Phys. JETP 5, 208-15(1957) Sept.

The general form of the eigenfunction of an electron in a periodic electric and a uniform magnetic field is derived. The equation of motion and the quasi-classical energy levels are found for an electron with an arbitrary dispersion law in a magnetic field. The broadening of the discrete energy levels of an electron in a crystal in a magnetic field is calculated. (auth)

4893
CONCERNING THE POSSIBILITY OF AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURE OF THE ELECTRON. V. A. Petukhov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 317-19(1957) Sept.

Studies of elastic scattering of 100, 188, and 236 Mev electrons by protons at rest have previously permitted the determination of the mean square radius of the proton. All these computations and interpretations of experimental results, however, were based on the assumption of a dimensionless electron. The distribution of charge inside the electron is important not only from the point of view of using the particle for investigation of structures of heavy nuclei, but because of its being of interest to physics in general. An experimental solution of this question makes it necessary to have a source of ~40 Bev electrons for the case of the immovable electron target. At present there are no known methods of developing accelerators for obtaining electrons of such high energy (~40 Bev). (A.C.)

Gases

4894 UCRL-5071
[California. Univ., [Livermore], Radiation Lab.]
GASEOUS DETONATION—BIBLIOGRAPHY. G. R. Maynard and Fred Frost. Oct. 28, 1957. 28p. Contract [W-7405-eng-48]. $4.80(ph OTS); $2.70(mf OTS).

This bibliography is divided into 2 sections; one listing books & journal articles, the second listing classified and unclassified documents for the period 1941 to date. Although an attempt was made to include only references to material dealing with gaseous detonation, explosions, and shock waves, there are some references that may deal, at least in part, with liquids and solids. Material on instruments used in measuring and studying gaseous detonations are included under a separate heading in the first section. The bibliography is arranged chronologically with latest references placed first. (auth)

4895
RELATIVE STOPPING POWERS IN PURE GASES. Norman A. Baily and George C. Brown (Roswell Park Memorial Inst., Buffalo, N. Y.). Radiology 70, 96(1958) Jan.

Instruments

4896 AECU-3469
Sandia Corp., Albuquerque, N. Mex.
A METHOD FOR COORDINATION AND FABRICATION OF A TWO-SIDED PRINTED CIRCUIT BOARD. M. H. McGirk. Jan. 16, 1957. 15p. Contract [AT(29-1)-789]. (TM-226-56-12). $3.30(ph OTS); $2.40(mf OTS).

A new method for limited-quantity production of two-sided printed circuit boards, using drill jigs and close-fit holes and pins for indexing, makes possible greatly improved accuracy in registry between the sides of the boards, as well as a considerable gain in production time. (auth)

4897 AECU-3470
Sandia Corp., Albuquerque, N. Mex.
AN X-BAND TIMER INTERVAL MEASURING SYSTEM. Ned Wilde. Feb. 6, 1957. 43p. Contract [AT(29-1)-789] (TM-25-57-14). $7.80(ph OTS); $3.30(mf OTS).

This report describes an x-band telemetering system which can be used to measure the time interval between two events. The measurement accuracy of the over-all system is ±0.025 microsecond for intervals from 0.2 microsecond to several hundred microseconds. Measured time intervals can be presented on oscilloscope presentations or can be read directly from a gated scaler which is included in the system. By use of tracking antenna systems the telemeter range can be over 10 miles with considerable gain margin. (auth)

4898 AECU-3472
Sandia Corp., Albuquerque, N. Mex.
A BINARY-TO-DECIMAL CONVERTER. Samuel D. Stearns. Sept. 1, 1956. 40p. Contract [AT(29-1)-789]. (TM-54-57-51). $6.30(ph OTS); $3.00(mf OTS).

A system of standard electronic logical circuits which stores a seven-bit binary number, converts the binary number to its decimal equivalent, and then indicates the decimal equivalent in direct-reading neon lights is described. (auth)

4899 HW-53632
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLATING THICKNESS TESTER. C. E. Fitch, Jr. Nov. 15, 1957. 19p. Contract W-31-109-Eng-52. $0.75(OTS).

An electromagnetic eddy current instrument is described that is capable of measuring copper and nickel plating 1 to 8 mils thick plated on bismuth mandrils of various sizes and shapes. Plating thicknesses can be measured accurately to within ±0.5 mils. (auth)

4900 NP-6561 (Rpt: UNCLASSIFIED)
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
A VISCOMETER FOR MOLTEN METALS. W. B. Muir. Oct. 21, 1957. 15p. (TR-146/57).

A simple noncritical viscometer is described which is in the process of development. The instrument is capable of measuring the relative viscosity of a low-melting metal from its melting point to about 500°C. The progress made on this project during the past two years is reviewed. (A.C.)

4901 SCTM-70-56(14)
Sandia Corp., Albuquerque, N. Mex.
A FILM READER AND ANALYZER. R. M. McGehee. Apr. 30, 1956. 16p. Contract [AT(29-1)-789]. $3.30(ph OTS); $0.40(mf OTS).

A film reader and analyzer has been developed to read amplitudes from a sequence of radar terrain return pulses recorded on 35 mm film. An amplitude distribution of the samples is presented numerically on an array of electromechanical counters as the film is read. A step waveform is constructed from the sample sequence and is recorded in permanent form. A frequency analysis is made on the waveform, also in permanent form. Reading is done at 600 samples per minute. The frequency analysis requires about 15 minutes after reading is completed. (auth)

4902 SCTM-271-57(14)
Sandia Corp., Albuquerque, N. Mex.
TIME-DELAY CIRCUIT (0.9 TO 6.5 MICROSECONDS). John M. Willis. Oct. 2, 1957. 16p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The purpose of this circuit is to provide a time-delay source consisting of six fixed delays in the range from 0.9 to 6.5 microseconds. Earlier delay circuits used a shorted artificial transmission line for these short delays; however, the LC delay circuit described here can be made more compact than the delay line and equally accurate. (auth)

4903

FALLING-DROP TIMING CIRCUIT WITH AUTOMATIC RESET. D. J. Fisher (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 308(1958) Feb.

The circuit was designed as a component of a falling-drop densimeter. Where Stokes law is valid, the time of fall of a spherical drop between two fixed points is inversely proportional to its density. The drop is caused to fall through two light beams. This circuit can determine the fall time of a drop of clear water as small as 1 μl and was used routinely to determine the density of 5-μl sample drops whose density ranged from about 1 to 2 g/ml. (L.T.W.)

4904

SENSITIVE MEASUREMENT OF PULSE-AMPLIFIER GAIN. K. A. McCollom, D. R. deBoisblanc, and J. B. Thompson (Phillips Petroleum Co., Idaho Falls, Idaho) Nucleonics 16, No. 1, 74-6, 78(1958) Jan.

Determining the long-term gain stability of pulse amplifiers for nuclear counters has been a problem for the amplifier designer for some time. This need has led us to design an amplifier comparator that not only checks gain stability to within 0.01% but also can be used for other purposes such as to compare the amplitude stability of two pulse generators to within 0.02%. The comparator determines gain stability by comparing amplified pulses with attenuated pulses from the same source. Both pulse trains pass through a threshold device that subtracts the same voltage from each pulse and amplifies the remainder. The result is a very precise measurement of gain stability requiring only that the characteristics of a passive attenuator network remain constant. By the use of this technique and suitable feedback control, an amplifier having extremely high pulse gain stability becomes possible. (auth)

Isotopes

4905 AEC-tr-3093

DEVELOPMENT OF ISOTOPE PRODUCTION IN THE USSR. (Razvitiye Proizvodstva Izotopoy v SSSR). Yu. S. Frolov, V. V. Bochkarve, and E. E. Kulish. 14p. $0.50 (OTS).

Booklet published by the All-Union Scientific-Technical Conference on the Utilization of Radioactive and Stable Isotopes and Radiations in the National Economy and in Science, Main Administration for the Utilization of Atomic Energy of the Council of Ministers of the USSR and the USSR Academy of Sciences. Moscow, 1957.

A review is presented of the development of radioisotope production in the U.S.S.R. Various aspects of development and applications of radioactive and stable isotopes are described. The selection and preparation of chemical reagents used as raw materials, methods of production, containers and storage of radioisotopes, and operations with radiation sources are discussed. Radiation sources, production technology, and assortment of preparations and tracer compounds are analyzed. A short summary is given on the current and prospective shipments to foreign markets and on the centralization of enterprises, engaged in isotope production, under "Soyuzreactiv" (Union Reagent) Trust of U.S.S.R. Ministry of Chemical Industry. (R.V.J.)

4906 NP-tr-18

THE DIFFUSION OF FISSION XENON FROM URANIUM METAL. K. E. Zimen and L. Dahl. Translated from Z. Naturforsch. 12a, 167(1957). 4p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 11, as abstract No. 5953.

4907

THE MEASUREMENT OF THE NUCLEAR SPINS AND STATIC MOMENTS OF RADIOACTIVE ISOTOPES. W. A. Nierenberg (Univ. of California, Berkeley). Ann. Rev. Nuclear Sci. 7, 349-406(1957).

4908

RADIONUCLIDES ARRANGED BY GAMMA-RAY ENERGY. Gilbert W. Smith and Donald R. Farmelo (Curtiss-Wright Corp., Quehanna, Penna.). Nucleonics 16, No. 2, 80-1 (1958) Feb.

A table of radionuclides, arranged in order of the energies of their emitted photons, was compiled from the literature to Oct. 1956 and the annual cumulations of nuclear data in Nuclear Science Abstracts. (J.S.R.)

4909

RADIOISOTOPES, A NEW TOOL FOR INDUSTRY. Sidney Jefferson. London, George Newnes Limited, 1957. 117p.

This volume is divided into two parts. Part one discusses the industrial application of radioisotopes as radioactive markers, leak detectors, and thickness, level, and density gages. Part two discusses the elementary fundamentals of radioactivity. (W.L.H.)

Mass Spectrography

4910 AEC-tr-3134

MASS-SPECTROMETER WITH RESOLVING POWER OF THE ORDER OF SEVERAL THOUSANDS. B. A. Mamyrin and B. N. Shustrov. Translated from Zhur. Tekh. Fiz. 27, 1347-56(1957). 15p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 11, as abstract No. 12132.

Mathematics

4911 AIR-10 (Rpt: UNCLASSIFIED)

Michigan. Univ., Ann Arbor. Engineering Research Inst. APPLICATION OF DIFFERENCE TECHNIQUES TO HEAT FLOW PROBLEMS USING THE ELECTRONIC DIFFERENTIAL ANALYZER. R. M. Howe. May 1954. 122p. Project 2115-3-T. Contract DA-20-018-ORD-21811. (ERI-2115-3-T).

This report continues the description of the application of electronic differential analyzers to partial differential equations of physics and engineering by using difference techniques. Earlier reports dealt with the lateral vibrations of beams, including both linear and nonlinear damping terms. In this report both linear and nonlinear dynamic problems involving heat flow are treated. In all cases time is preserved as a continuous variable; distance through the conducting medium is divided into stations and derivatives with respect to the spacial coordinates are approximated by finite differences. The resulting simultaneous ordinary differential equations are then solved by the electronic differential analyzer. Heat-flow problems treated include one and two-dimensional flow in rectangular media as well as flow in cylindrical and spherical media. In all cases theoretical accuracy of the difference method as a function of the number of stations is analyzed and example computer solutions are presented. Change of

independent variable to improve accuracy and to solve flow in semi-infinite media is discussed with sample solutions. The heat equation for a medium having a conductivity proportional to its temperature is solved with the electronic differential analyzer and results are compared with a particular exact solution. (auth)

4912 CF-58-1-3
Oak Ridge National Lab., Tenn.
ANALOG COMPUTING. C. S. Walker. Jan. 17, 1958. 49p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30 (mf OTS).

An analog computer, or simulator, is discussed in an elementary manner. A few of the operations which can be performed by an analog facility are described. The operation of a computer as a reactor simulator is discussed at length. (M.H.R.)

4913 CF-58-1-29
Oak Ridge National Lab., Tenn.
THE DOUBLE SPHERICAL HARMONICS METHOD IN SPHERICAL GEOMETRIES. A. Sauer. Jan. 22, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

The spherical Milne problem is treated by a modification of the spherical harmonics method in which different Legendre expansions are employed in the forward and backward directions (Yvon's modification). It is found that the resulting system of differential equations has no solution, and it can be evaluated only with the help of additional considerations, which however tend to decrease the quality of the approximation considerably. The calculations are carried out in detail in the P_1^3-approximation, and the results compared with those found by other methods. It is concluded that the double spherical harmonics method in spherical geometries is unsuited for numerical calculations. (auth)

4914 CRNE-747
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
SOLUTION OF TEMPERATURE AND STRESS TRANSIENTS BY ANALOGUE COMPUTER. T. E. Burnup. Dec. 5, 1957. 27p. (AECL-536). $1.00(AECL).

A method of solving temperature and stress transients in solids is given in a form suitable for use on an analog computer of the operational amplifier type. The method is applicable to cases where one dimensional approximation is sufficient. (auth)

4915 NRL-5052
Naval Research Lab., Washington, D. C.
COMPARISON OF SOLUTIONS TO THE ONE-VELOCITY NEUTRON DIFFUSION PROBLEM. L. A. Beach, R. B. Theus, P. Shapiro, R. C. O'Rourke, W. R. Faust, and B. Lepson. Oct. 21, 1957. 49p.

By Fourier transform techniques the exact solutions of the one-velocity neutron diffusion problem were derived for plane isotropic, plane parallel monodirectional, and plane parallel bidirectional source terms. These exact solutions in terms of Fourier inversion integrals were numerically evaluated upon the Narec to give the angular distribution of the scattered intensity, total scattered intensity, and total intensity. By solving the integrals by contour integration in the complex plane, asymptotic solutions were obtained which are good approximate solutions for deep penetrations and problems with little absorption. Moment method solutions were derived and evaluated to be in good agreement with the exact solutions for symmetric source and intensity functions. Monte Carlo esimates can be obtained that correctly account for source asymmetries and boundary discontinuities and which can be extended to at least 20 mean free paths utilizing suitable bias techniques such as the exponential transformation. (auth)

4916 NYO-7974
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
DIFFERENTIAL EQUATIONS, DIFFERENCE EQUATIONS AND MATRIX THEORY. P. D. Lax. Nov. 15, 1957. 40p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

Friedrichs, in his studies of difference approximations to solutions of symmetric hyperbolic systems, has shown that difference schemes with positive coefficients are stable. In this paper it is shown that this stability criterion of Friedrichs is valid for difference approximations to arbitrary hyperbolic systems. The proof relies on the convexity and monotonicity of eigenvalues as matrix functions over a linear space of matrices with only real eigenvalues. These theorems, well known in the symmetric case, are proved with the aid of theorems concerning the dependence of solutions of hyperbolic equations on their initial data. (auth)

4917 SCTM-337-57(14)
Sandia Corp., Albuquerque, N. Mex.
A MEMORY-DIRECTED READING MACHINE. G. R. Bussey. Jan. 3, 1958. 5p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A magnetic-drum memory system, employing table lookup (TLU) and digital programming, is proposed for reading information in widely differing scripts or types. (auth)

Measuring Instruments and Techniques

4918 AECU-3565
California Research Corp., Richmond, Calif.
MONITORING THE MTR CANAL GAMMA SOURCE—A TREATMENT OF RELIABILITY. J. G. Carroll. Aug. 31, 1957. 18p. Contract AT(11-1)-174, Report No. 10. $0.75(OTS).

Spent fuel elements from nuclear reactors are used extensively as gamma radiation sources. Such a source has been in operation since 1952 at the National Reactor Testing Station in Idaho. Three recognized monitoring techniques were used: reduction of ceric ion; calorimetry; and ion chamber methods. (W.L.H.)

4919 AERE-C/R-2223
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MONITORING OF EFFLUENT FOR ALPHA EMITTERS. PART II. METHODS FOR THE DETERMINATION OF URANIUM, POLONIUM AND OTHER ALPHA EMITTERS. A. A. Smales, L. Airey, J. Woodward, and D. Mapper. June 1950. Decl. with amendment Mar. 1957. 35p. $0.90(BSI).

Consideration has been given to the problem of separating and estimating uranium, polonium, and other alpha emitters (in order to provide analytical methods for their routine determination in conformity with the draft agreement on the Harwell effluent). Uranium may be ether extracted from solutions of ammonium nitrate as salting out agent at pH1 with an efficiency of 98 to 99%. The deposition of polonium on silver foil is a specific method for this element and under prescribed conditions similar extraction efficiencies may be obtained. An adequate separation from all "other alpha emitters" is obtained and methods for the estimation of these are discussed. A comprehensive scheme involving a preliminary activity

concentration step has been elaborated. Uranium, polonium, and the majority of the "other alpha emitters" are precipitated as their tannin complexes at pH8 using calcium hydroxide, the calcium-tannin complex acting as a carrier. That part of the activity remaining in solution is determined as in the total activity method, previously described. From the solution of the precipitate, polonium is first separated by electrodeposition, and then uranium by ether extraction in the presence of ammonium nitrate. The majority of the "other alpha emitters" still in the aqueous ammonium nitrate solution are collected on a second calcium-tannin precipitate, while the small part remaining in solution after this operation is obtained by direct evaporation. (auth)

4920 AERE-HP/R-2383

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE BETA COUNTING OF U^{237} AND Np^{239}. N. G. Stewart. Sept. 1954. Decl. with amendment Sept. 1957. 4p.

Declassified version of AERE-HP/M-80.

The determination of the disintegration rates of samples of U^{237} and Np^{239} by beta counting in an end-window system is rendered difficult by the presence of internal conversion electrons. The results of experiments carried out to determine over-all correction factors which take account of both counter window absorption and the conversion electron fraction of these two isotopes when measured in a standard EHM2 counter assembly are given. (auth)

4921 DP-249

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A GAMMA ABSORPTOMETER FOR THE CONTINUOUS ANALYSIS OF SOLUTIONS OF HEAVY METAL SALTS. Donald H. Thurnau. Nov. 1957. 31p. Contract AT(07-2)-1. $1.00(OTS).

A gamma absorptometer was developed to measure the concentration of heavy metal salts in process streams. The analysis is made by measuring the absorption of a beam of gamma rays by sample solutions. A dual beam system compensates for electronic drift and permits a precision of better than ±0.5%. (auth)

4922 HW-35752

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE EVALUATION OF AIR SAMPLES CONTAINING THORIUM AND DAUGHTER PRODUCTS. J. W. Healy. Mar. 14, 1955. 19p. Contract [W-31-109-eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

Equations for the quantity of Th daughters on an air sampler after various times of collection and decay are derived and evaluated. The most limiting assumption is the constant concentration over the sampling period. Applications of these equations to measurement of decay curves, α energy analysis and the simultaneous solution involving measurements at three decay times are discussed. (auth)

4923 LAMS-2154

Los Alamos Scientific Lab., N. Mex.

LIQUID-SCINTILLATOR AND REFLECTIVE-COATING STUDY. Alfred Arakengy and R. M. Kloepper. Sept. 1957. 11p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

This report is a study of the comparative responses of some scintillators in tanks of various reflective coatings to gamma rays from Cs^{137} and Co^{60} sources. In order of decreasing quality, the scintillators tested, all of which contained p-terphenyl, were toluene-POPOP, xylene-α-NPO, polystyrene-α-NPO, and triethylbenzene-POPOP. The reflective coatings tested were: Plasite, α-alumina in sodium silicate, and titanium dioxide in Zapon Aquinate Lacquer. (auth)

4924

APPLICATIONS OF A MULTI-CHANNEL GONIOMETER. Torsten Lindqvist and Erik Karlsson. Arkiv Fysik 12, 519-36(1957).

A multichannel goniometer (MCG) for gamma-gamma angular correlation measurements is described. The apparatus has four channels. Various methods of measurement and a complete treatment of data are given. The MCG has been carefully tested with well known correlations (Bi^{207}, Hf^{181}, and Co^{60}). As applications the angular correlations of gamma cascades from Ba^{131} and Nd^{147} have been investigated. Both cases involve *l*-forbidden magnetic dipole transitions. From the mixing ratios determined in the correlation experiments it is possible to estimate the strength of forbiddenness. An upper limit of the g-factor of the 92 kev level in Pm^{147} is determined by studying the influence of a magnetic field on the angular correlation. (auth)

4925

PHOTOIONIZATION VERSUS PHOTOELECTRIC EFFECT FOR DISCHARGE SPREAD AND OUTPUT PULSE MEASUREMENTS IN G-M COUNTERS. P. S. Gill and S. P. Puri (Muslim Univ., Aligarh, India). Indian J. Phys. 31, 564-71 (1957) Nov.

The probability of discharge spread versus overvoltage has been measured in a multicathode, single-anode counter, by keeping dead the space across which the discharge spreads. The pulse size versus voltage curves for the externally coated counters, reveal that the operation of soft glass type is analogous to that of the conventional counter, whereas in case of pyrex counter, the deposition of the positive ions across the inner glass surface develops an opposing e.m.f., which varies linearly with the overvoltage. Besides, discharge spread probability has been studied as a function of overvoltage in a multicathode, segmented counter, making use of beads sealed on to the wire. The beads suppress the photoionization contribution by reducing the field around them, thus elmininating altogether the photoionization near the immediate vicinity of the wire, which, in normal operation, contributes to the stepwise discharge spread. The photoelectric effect responsible for discharge spread remains negligibly feeble but constant over an overvoltage of about 400 volts in the case of present counter with the rare gas-organic vapor admixture. (auth)

4926

CLINICAL DOSIMETRY. H. E. Johns (Ontario Cancer Inst., Toronto), G. D. Adams, H. L. Andrews, L. H. Lanzl, J. S. Laughlin, and W. K. Sinclair. Radiology 70, 96-7 (1958) Jan.

4927

ON THE NATURE OF THE CONE-LIKE SHAPE OF TRACKS OF MULTI-CHARGED IONS IN NUCLEAR EMULSIONS. O. V. Lozhkin (Academy of Sciences, USSR). Soviet Phys. JETP 5, 293-7(1957) Sept.

Photometric investigations of the tracks of multi-charged particles in fine grained nuclear emulsions of various sensitivity indicate that the thinning down of the track near the end of the range is not due to variation of the total specific energy losses but to variation of the energy spent by δ electrons with $E \geq 2$ kev near the track axis. A new method for measuring the total charge of multi-charged particles in fine grained nuclear emulsions is described. (auth)

4928

BETA-EXCITED X-RAY SOURCES FOR SCINTILLATION-SPECTROMETRY CALIBRATION. James G. Kereiakes, G. R. Kraft, O. E. Weir, and A. T. Krebs (U. S. Army Medical Research Lab., Fort Knox, Ky.). Nucleonics 16, No. 1, 80-2(1958) Jan.

A study is presented on the use of various target materials in the form of metallic foils, free elements, or compound salts as sources of β-excited x radiation for low-energy-range (0 to 100 kev) calibration in gamma scintillation spectrometry. (L.M.T.)

4929

NEUTRON, GAMMA MEASUREMENTS FOR IN-PILE POWER MONITORING. A. C. Lapsley (E. I. du Pont de Nemours & Co., Aiken, S. C.). Nucleonics 16, No. 2, 106, 108, 110(1958) Feb.

Neutron and γ-ray monitors have been developed for use inside reactors. The γ-ray monitor is a miniature ion chamber with an insulation of synthetic sapphire. The neutron monitor uses a thermocouple to measure the heat generated by (n,p) reactions in U. An alloy button formed from U and Al is welded to the Al jacket of the thermocouple. Both monitors performed satisfactorily in in-pile tests. (J.S.R.)

4930

OXIDE ON CATCHER FOILS SPOILS POWER MEASUREMENTS. J. N. Renaker, V. J. Stratton, and H. L. Bermanis (General Electric Co., Cincinnati, Ohio). Nucleonics 16, No. 2, 127-8(1958) Feb.

Reactor power measurements, made by Al foil placed in close contact with U foil and exposed in the reactor at the point to be measured, are often irreproducible because of the nonuniformity of oxide film on the U foils used. The cleaning of U foils immediately prior to use is therefore recommended. (J.S.R.)

4931

PRODUCTION OF GEIGER–MUELLER COUNTERS IN POLAND. A. Janikowski (Industrial Inst. of Electronics, Warsaw). Nukleonika 2, 489-505(1957). (In Polish)

A review is given of the design, performance, and general parameters of Geiger-Mueller counters currently produced in various laboratories in Poland. (tr-auth)

4932

ON THE THEORY OF THE BUBBLE CHAMBER. Frederick Seitz (Univ. of Illinois, Urbana). Phys. Fluids 1, 2-13(1958) Jan.-Feb.

An attempt is made to analyze the factors which determine the operation of the bubble chamber. It is concluded that the majority of bubbles in conventional chambers are nucleated by moderately energetic free electrons produced by the incident particles in Coulomb encounters. Nuclei are displaced too infrequently by Coulomb encounters to account for the observed densities of bubbles. The electrons deposit their kinetic energy in highly localized regions which then are the source of explosions which produce bubbles of greater than critical size in a time of the order of 10^{-10} or 10^{-11} sec. The bubbles grow subsequently by evaporation of the fluid. The temperature of the fluid should be sufficiently close to the critical temperature that the energy required to produce the bubble of critical size can be provided by an electron with a range comparable to or less than the diameter of the bubble of critical size. Otherwise the electron will be unable to localize its energy in a sufficiently small volume in any but highly improbable cases. It is also concluded that the viscosity of the liquid plays a very important role in determining the threshold energy for forming a bubble of critical size when it has a value near 1 centipoise or larger. (auth)

4933

THE USE OF AUTOMATIC COMPUTING MACHINES FOR IMPLANT DOSIMETRY. R. F. Nelson and M. L. Meurk (Memorial Center, New York). Radiology 70, 90(1958) Jan.

4934

INVESTIGATION OF THE X-RAY EMISSION SPECTRUM FROM LESIONS AND TISSUE-EQUIVALENT SOURCES CONTAINING P^{32}. K. E. Corrigan and H. Hayden Corrigan (William Beaumont Hospital, Royal Oak, and Wayne State Univ., Detroit, Mich.). Radiology 70, 91(1958) Jan.

4935

SPECTRAL DISTRIBUTIONS OF 140-kvp X-RAYS. D. V. Cormack, D. G. Burke, and W. E. Davitt (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Saskatoon, Sask.). Radiology 70, 91-2(1958) Jan.

4936

DETERMINATION OF THE ABSORBED DOSE IN RADIATION THERAPY. J. Robert Andrews, Robert W. Swain, Herman D. Suit, and Charles R. Maxwell (Dept. of Health, Education and Welfare, Bethesda, Md.). Radiology 70, 92(1958) Jan.

4937

A METHOD FOR IN VITRO DETERMINATION OF TISSUE DOSE FROM THOROTRAST. R. J. Schulz (Albert Einstein College of Medicine, New York). Radiology 70, 94-5(1958) Jan.

4938

MEASUREMENT OF THE NEUTRON RESPONSE OF A GRAPHITE-CO_2 IONIZATION CHAMBER. J. A. Sayeg, P. S. Harris, and T. A. Allison (Los Alamos Scientific Lab., N. Mex.). Radiology 70, 95-6(1958) Jan.

Mesons

4939

MU-MESON PHYSICS. J. Rainwater (Columbia Univ., New York). Ann. Rev. Nuclear Sci. 7, 1-30(1957).

4940

HYPERONS AND HEAVY MESONS (SYSTEMATICS AND DECAY). Murray Gell-Mann (California Inst. of Tech., Pasadena) and Arthur H. Rosenfeld (Univ. of California, Berkeley). Ann. Rev. Nuclear Sci. 7, 407-78(1957).

4941

INTERACTION AND DECAY OF NEGATIVE K-PARTICLES IN FLIGHT. G. Goldhaber, S. Goldhaber, E. L. Hoff, J. E. Lannutti, and F. H. Webb (Univ. of California, Berkeley). Nuovo cimento (10) 4, Suppl. No. 2, 367-70 (1956).

4942

SEARCH FOR ASYMMETRIES IN THE SCATTERING AND DECAY OF PIONS. A. V. Crewe, U. E. Kruse, R. H. Miller, and L. G. Pondrom (Univ. of Chicago, Ill.). Phys. Rev. 108, 1531-3(1957) Dec. 15.

The possibility of nonzero spin for the π meson has recently been reconsidered. This might manifest itself in asymmetries in scattering of pions or anisotropies of $\pi-\mu$ decays. In this experiment, asymmetries in the scattering of pions from carbon and in the decay of pions in flight were sought by using counter techniques. No left-right or up-down scattering asymmetry was observed within a combined statistical and systematic precision of 6 to 7%. No decay asymmetry was observed within a combined statistical and systematic precision of 5%. (auth)

4943

COSMIC-RAY MEASUREMENT OF τ^- AND K-MESON MEAN LIVES. J. W. Keuffel, G. J. Morris, R. K. Stitt,

R. L. Call, and W. H. Sandmann (Univ. of Utah, Salt Lake City). Phys. Rev. 108, 1584-8(1957) Dec. 15.

The mean lifetimes of τ and K mesons have been measured using mesons produced by the cosmic radiation in a large generating layer of brick and Pb. The particles come to rest in a 64-kg liquid scintillation detector, where they are identified by pulse height and by the time pattern of 2.2-μsec decay electrons arising from the heavy-meson secondaries. A novel pulse-forming circuit generates a fiducial pulse at time zero and a pulse corresponding to the heavy-meson decay, all within the same scintillator. A sample of 158 K particles, mostly $K_{\mu 2}$'s, yields a lifetime value of $(10.9 \pm 1.3) \times 10^{-9}$ sec. The lifetime of the τ is $(11.3_{-1.3}^{+1.8}) \times 10^{-9}$ sec, based on 20 events. These results are in good agreement with values obtained at the accelerators. (auth)

4944

SPACE PROPERTIES OF THE π MESON. R. L. Garwin, G. Gidal, L. M. Lederman, and M. Weinrich (Columbia Univ., New York). Phys. Rev. 108, 1589-93(1957) Dec. 15.

Measurements have been made of the circular polarization of the decay photons emitted from an "unpolarized" sample of π^0 mesons, the asymmetric emission of μ^+ mesons from cyclotron-produced π^+ mesons, and the asymmetric emission of μ^+ mesons from π^+ mesons produced in weak interactions. All three experiments give negative results. (auth)

4945

POSSIBLE NONLOCAL EFFECTS IN μ DECAY. T. D. Lee (Stanford Univ., Calif.) and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 108, 1611-14(1957) Dec. 15.

Possible nonlocal effects in μ decay are investigated phenomenologically. It is shown that the possible difference between the experimental ρ value from $^3/_4$ can be attributed to such nonlocal phenomena. (auth)

4946

GENERAL PARTIAL WAVE ANALYSIS OF THE DECAY OF A HYPERON OF SPIN $^1/_2$. T. D. Lee and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 108, 1645-7(1957) Dec. 15.

In this note consideration is given to the general problem of the decay of a hyperon of spin $^1/_2$ into a pion and a nucleon under the general assumptions of possible violations of parity conservation, charge conjugation invariance, and time-reversal invariance. The discussion is in essence a partial wave analysis of the decay phenomena and is independent of the dynamics of the decay. Nonrelativistic approximations are not made on either of the products. (A.C.)

4947

DECAY OF THE τ MESON. I. N. Mikhailov. Soviet Phys. JETP 5, 265-8(1957) Sept.

The energy spectrum of the π mesons resulting from the decay of the τ meson is calculated on the assumption that the isotopic spin of the τ meson is one. (auth)

4948

EXPERIMENTAL COMPARISON OF THE ENERGY SPECTRA OF γ-QUANTA FROM THE DECAY OF π^0-MESONS FORMED ON CARBON AND LEAD NUCLEI BY 600 Mev PROTONS. Iv. D. Baiukov, A. N. Sinaiev, and A. A. Tiapkin (United Inst. for Nuclear Research). Soviet Phys. JETP 5, 299-301(1957) Sept.

Experiments conducted indicate that there is no essential difference in γ spectra formed by light and heavy elements in the region of high energies. Since energy and angular distributions are interrelated, the conclusion is made that quanta formed by light and heavy elements are coincidental for high energies. Computations made for the case of γ spectra show that γ spectra formed by light and heavy elements should differ significantly only in the region of low energies. To obtain a more accurate comparison of γ spectra formed in light and heavy nuclei, relative measurements were made of γ spectra resulting from the decay of mesons formed in carbon and lead by 600-Mev protons at 0° observation angle with reference to the protons. (A.C.)

4949

THE THRESHOLD OF "CREATION" AND THE THRESHOLD OF "GENERATION" OF NEGATIVE K-PARTICLES. M. Danysh and B. Pontecorvo (United Inst. of Nuclear Studies). Soviet Phys. JETP 5, 325-6(1957) Sept.

4950

THE μ-DECAY OF K-PARTICLES AND HYPERONS. L. B. Okun. Soviet Phys. JETP 5, 334-5(1957) Sept.

It has been recently suggested that the weak interactions of μ mesons and neutrinos with pions and K particles are primary, and that the interactions of μ mesons with hyperons and nucleons are secondary effects of the weak primary boson-fermion interaction. Some elementary consequences of this hypothesis are considered, and possible experimental tests of it are discussed. (A.C.)

4951

CONSERVATION LAWS IN WEAK INTERACTIONS. L. D. Landau (Academy of Sciences, USSR). Soviet Phys. JETP 5, 336-7(1957) Sept.

4952

INTERACTION OF SLOW π-MESONS WITH NUCLEI. A. M. Baldin and A. I. Lebedev (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1221-6(1957) Nov. (In Russian)

The influence is considered of the effect of the interaction of charged mesons with a nucleus on the cross section of the production of mesons on nuclei in the case when the wavelength of the meson exceeds the size of the nucleus. A relation is obtained connecting the cross section of photoproduction of mesons with the shifts and widths of mesoatomic levels. A comparison with experimental data permits of a number of conclusions concerning the interaction of mesons with groups of nucleons and the mechanism of the photoproduction of mesons on nuclei. (tr-auth)

Meteorology

4953

ELECTRONIC WIND VANE—ARGONNE NATIONAL LABORATORY. H. Moses and G. R. Hilst (Argonne National Lab., Lemont, Ill.). Exploring the Atmosphere's First Mile 1, 243-7(1957).

The wind vane described is unlike the conventional wind vane in that it does not use the force of the wind itself to drive it to the null or indicating position. Instead it uses a sensitive element similar to a microphone to detect any deviation from the null position. By this means it is possible to make an instrument which is considerably faster in response than the conventional wind vane and can respond to a wider range of wind speeds. (L.T.W.)

Molecular Properties

4954

NUCLEAR QUADRUPOLE COUPLING IN THE Li_2 MOLECULE. Isao Mannari (Kyoto Univ., Japan) and Tadashi Arai (Carnegie Inst. of Tech., Pittsburgh). J. Chem. Phys. 28, 28-31(1958) Jan.

The method of deformed atoms in molecules is applied to calculate the electric field gradient q at a nucleus in Li_2, using the molecular wave function obtained by Arai and Sakamoto. The field gradient is composed of nuclear and electronic terms which almost cancel each other, so that its magnitude and even its sign are seriously affected by accuracy of wave functions used. It is nevertheless expected that the A. S. wave function, which gives a dissociation energy of 0.96 ev compared with the experimental value of 1.05 ev, is sufficiently accurate. Neglecting the shielding effect induced in the 1s shell by the nuclear quadrupole moment Q, the result obtained is $q/2e = q' = -0.0034$ au at an internuclear distance of 4.93 au. The nuclear quadrupole coupling constant eqQ found experimentally is positive (+ 0.060 Mc/sec). A negative value of the quadrupole moment $Q(Li^7)$ thus is obtained, in agreement with the prediction of the nuclear shell model. (auth)

4955

APPLICATION OF THE METHOD OF DEFORMED ATOMS IN MOLECULES TO THE Li_2 MOLECULE. Tadashi Arai (Carnegie Inst. of Tech., Pittsburgh) and Michiko Sakamoto (Kyoto Univ., Japan). J. Chem. Phys. 28, 32-48(1958) Jan.

The method of deformed atoms in molecules, proposed previously to remedy deficiencies in the method of Moffitt, is employed to calculate energies of the ground state $^1\Sigma_g^+$ and the lower excited states $^3\Sigma_u^+$, $^1\Sigma_u^+$, and $^1\Pi_u$ of the Li_2 molecule. As basis for the molecular calculation, modified atomic functions are introduced to take deformation of atoms in molecules into account. These modified functions are constructed from atomic eigenfunctions in a manner which fully preserves correlation between electrons. Exact atomic energies are used to calculate the atomic energy parts of the matrix elements of the molecular calculation, while the energy defects due to deformation of atoms are determined by using approximate functions. The modified atomic functions are made up so that their charge distributions are well described by the use of Slater orbitals with equal orbital exponents for all atomic states. Interatomic interaction operators, overlap integrals, and energy defects due to deformation of atoms are calculated using Slater orbitals. For the $1s)^2 2s)2p)$ ^3P and ^1P states of the Li^- ion, the exchange correction due to binding a free electron into the 2p orbital is considered. The energy defects of Slater orbitals from Hartree-Fock orbitals are found to have small effect on the dissociation energy of the ground state. The calculations are performed for three sets of values for the orbital exponents. The dissociation energy obtained for one set of values is 0.96 ev, in good agreement with the observed value of 1.05 ev. The excitation energies obtained of 1.63 ev for $^3\Sigma_u^+ - {}^1\Sigma_g^+$, 2.05 ev for $^1\Sigma_u^+ - {}^1\Sigma_g^+$ and 2.59 ev for $^1\Pi_u - {}^1\Sigma_g^+$ also agree reasonably well with the corresponding observed values of (1.35 ev), 1.76 ev, and 2.54 ev. The calculation is discussed and compared with the orbital approach and Moffitt's method. Conclusions are stated regarding the nature of bonds and orbital exponents in Li_2. (auth)

Neutrons

4956 AECU-3595

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SURFACE FLUXES AND CURRENTS FOR VARIOUS SHIELDED RADIATION SOURCES. E. R. Cohen and F. B. Estabrook. Oct. 1, 1957. 23p. Contract AT-11-1-GEN-8. (AI-2031). $0.75(OTS).

The flux and current of radiation at the surface of shielded sources are calculated as a function of source radius and shield thickness. Curves are presented for source radius (or half-thickness) from 0 to 20 mean-free-paths and for shield thickness from 0 to 20 mean-free-paths for plane, cylindrical, and slab geometries. The curves are particularly useful for estimating flux leakage from large systems. Since Pe^T rather than P is the plotted function, the curves do not sacrifice accuracy. (auth)

4957 NDA-2074-1

Nuclear Development Corp. of America, White Plains, N. Y.

CALCULATIONS OF NEUTRON SPECTRA INSIDE KAPL IRRADIATION CAPSULES USED FOR MEASUREMENTS OF α IN U^{233}. Philip M. Mostov. Mar. 25, 1957. 28p. Contract AT(30-1)-862. $4.80(ph OTS); $2.70(mf OTS).

Measurements for various fissionable isotopes have been made by KAPL of α averaged over spectra in the intermediate energy range (1 to 1000 ev). These spectra were obtained by filtering neutrons in the Hanford reactors through small cylindrical shields of materials such as B, Cd, Gd, etc. fitted into the 1-in. diameter irradiation tubes. The methods and assumptions used in computing the neutron spectra transmitted through these shields are examined here. On the basis of age-diffusion calculations in a geometry approximating the reactor it is concluded that the spectrum incident on the shields is nearly 1/E in shape. To trace the subsequent penetration of the neutrons in the shield used for U^{233}, Monte Carlo calculations were performed for spherical geometries with the NDA MIS code developed for the Datatron. These calculations show that the presence of the shield does not significantly affect the 1/E incident spectrum. They also indicate that scatterings in the shield materials are not important, so that the assumption that all collisions in the shield are absorptive is quite adequate for the purpose. It was found also that the spherical geometries poorly approximated some of the features of the cylindrical shaped shields. It is therefore recommended that calculation of the spectra incident on the samples in the actual shields be made only on the basis of cylindrical geometry, but that a simple exponential attenuation kernel could be assumed. (auth)

4958

A NEW METHOD FOR MEASURING THE POLARIZATION OF MEDIUM ENERGY NEUTRONS AND THE PHASE SHIFT ANALYSIS OF $\eta - He^4$ SCATTERING. I. I. Levintov, A. V. Miller and V. N. Shamshev. Soviet Phys. JETP 5, 258-64(1957) Sept.

A helium analyzer to measure the polarization of neutrons in the 1 to 18 Mev energy range is described. The efficiency of the analyzer is about 100% in this range, and a typical counting rate is ~ 20 counts/min at a current of 10^3 neutrons/cm^2 sec. The background is practically zero. The azimuthal asymmetry in the scattering of (D + D) neutrons from He^4 has been measured at neutron energies of 2.4 and 3.4 Mev. Analysis of the results agrees with the experimental phase shifts given by Seagrave and disagrees with those of Huber and Baldinger. (auth)

Nuclear Physics

4959 COO-173

Purdue Research Foundation, Lafayette, Ind.

RESEARCH IN NUCLEAR PHYSICS. Progress Report No. 6. June 1, 1956. 61p. Contract AT(11-1)-122. $0.40(OTS).

Results of scattering of 18-Mev α particles by Ne, Al, Ag, and Cu are plotted. Some information on the attenuation of the Cd^{111} directional correlation in various sources and the lifetime of the 247-kev excited state is given.

Nuclear spectroscopy data are included on F^{21}, the decay of Sc^{50} and S^{37}, Ca^{49}, Ga^{74}, and Cl^{40}. (For preceding period see COO-172.) (M.H.R.)

4960

NUCLEAR AND NUCLEON SCATTERING OF HIGH-ENERGY ELECTRONS. Robert Hofstadter (Stanford Univ., Calif.). Ann. Rev. Nuclear Sci. 7, 231-316(1957).

4961

COLLISIONS OF $\lesssim 1$ Bev PARTICLES (EXCLUDING ELECTRONS AND PHOTONS) WITH NUCLEI. S. J. Lindenbaum (Brookhaven National Lab., Upton, N. Y.). Ann. Rev. Nuclear Sci. 7, 317-48(1957).

4962

RECENT INVESTIGATIONS IN PHYSICS OF FUNDAMENTAL PARTICLES. L. I. Lapidus and E. O. Okonov. Priroda 46, 33-42(1957) Nov. (In Russian)

Investigations performed with the Joint Inst. of Nuclear Research 680-Mev synchrocyclotron and 10-Bev synchrophasatron are described. Diagrams are given of the proton beam release from the synchrocyclotron and the fission of atomic nuclei induced by 9-Bev protons. Applications of thick emulsion method, diffusion chambers, and Cherenkov scintillation counters are described. Problems of nucleon-nucleon interactions of polarized nucleonic beams, strange particles (K and Λ), and μ mesons, as well as antiparticles, are studied. The research with the 10-Bev synchrophasatron promises better results in studies of antihyperons and their properties. (R.V.J.)

4963

WIGNER FORCES AND THE NUCLEAR SHELL MODEL. Mariano Bauer. Rev. mex. fís. 6, 141-52(1957) July. (in Spanish)

It is well known that velocity dependent forces or exchange forces (which could also be considered as a type of velocity dependent force), do not give the experimental level arrangement in nuclear shell theory. In particular, in the long range approximation, both velocity dependent forces and Majorana forces predict configurations with an odd number of particles and that the ground state has an angular momentum J which is the lowest compatible with the Pauli principle, and not J = j, where j is the angular momentum of the nucleons in the shell. The purpose of this paper is to see whether for Wigner forces (i.e. forces with no exchange character), the level arrangement is the experimental one for any range. It is shown that for the two particle configuration J = 0 will be the ground state independently of the range of the Wigner forces. For the three particle configuration in the $j = 5/2$ shell, the ground state is $J = 5/2$, but in the $j = 7/2$ shell, the ground state is $J = 7/2$ only in the short range approximation. It is concluded, therefore, that the experimental level arrangement is related to the short range character of the nuclear forces, rather than to their velocity dependence or exchange character. (auth)

4964

DEUTERON PHOTOEFFECT WITH A REPULSIVE CORE. M. L. Rustgi (Louisiana State Univ., Baton Rouge). Rev. mex. fís. 6, 135-40(1957) July.

An analytic result is given for the electric dipole contribution to the deuteron photoeffect cross section, for a central Serber force containing an r^{-2} repulsive core. A comparison between calculations and experiment indicates that for energies greater than 60 Mev other effects like the interaction in the final state and mesonic effects are of more importance than the inclusion of this repulsive core. Sum rule calculations are also discussed. (auth)

4965

NUCLEAR SATURATION AND THE LÉVY-KLEIN POTENTIAL OF PSEUDOSCALAR MESON THEORY. B. K. Kerimov (Moscow State Univ.). Soviet Phys. JETP 5, 326-8(1957) Sept.

4966

α-PARTICLES EMITTED BY HEAVY NUCLEI IN EMULSIONS UNDER THE ACTION OF HIGH-ENERGY PROTONS. P. A. Vaganov and V. I. Ostroumov (Leningrad Polytechnical Inst.). Zhur. Eksp. Teoret. Fiz. 33, 1131-9(1957) Nov. (In Russian)

The energy spectra of α particles emerging from the heavy nuclei in emulsions under the action of protons of energy 360, 560, and 660 Mev were investigated for different energies of excitation of these nuclei. Calculations of the evaporation spectrum showed satisfactory agreement with experiment in the α particle energy range up to 14 Mev without resorting to the LeCouteur hypothesis concerning the lowering of the Coulomb barrier. By subtracting the calculated spectrum of evaporation from the experimental one the energy distribution of cascade α particles and their relative number per star for all three energies of the experiment were obtained. (tr-auth)

4967

ON THE FORM OF β-INTERACTION. G. R. Khutsishvili and S. G. Matinyan (Academy of Sciences, Georgian SSR). Zhur. Eksp. Teoret. Fiz. 33, 1150-3(1957) Nov. (In Russian)

The influence is considered of the nonconservation of parity on the interpretation of experimental data involving Fierz interference and angular $(\beta-\gamma)$-correlation. Formulas are obtained for β decay of polarized nuclei. (tr-auth)

4968

AN EQUATION FOR GREEN'S FUNCTION OF A SYSTEM OF FUNDAMENTAL PARTICLES. V. G. Solovev (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1215-20(1957) Nov. (In Russian)

Green's functions are introduced for fundamental particles. On the basis of Lagrangians describing all strong interactions of mesons and baryons, closed systems of equations have been obtained for Green's functions in variational derivatives with respect to external currents both in three-space and in four-space of isotopic spin. (tr-auth)

4969

ON THE PROBLEM OF THE EXCITED STATES OF NUCLEONS. N. F. Nelipa (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1277-81(1957) Nov. (In Russian)

The short lived (nuclear times) and relatively long lived (10^{-10} sec) nucleon excited states are investigated. These states may be identified with hyperons. Considerations of hyperons in intermediate states explain the resonance effects. The scattering of π^- mesons on protons is considered. The magnitudes of the total cross section of scattering are in close agreement with the experimental ones. (tr-auth)

4970

HIGH ENERGY NUCLEAR PHYSICS. PROCEEDINGS OF THE SEVENTH ANNUAL ROCHESTER CONFERENCE, APRIL 15-19, 1957. G. Ascoli, G. Feldman, L. J. Koester, Jr., R. Newton, W. Riesenfeld, M. Ross, and R. G. Sachs, eds. New York, Interscience Publishers, Inc., 1957. 496p. $4.50.

One-hundred-twenty-nine papers in nine major conference categories are included. The major topics for discussion were nucleon structure, pion reactions, nucleon-nucleon interactions, theoretical physics, high-energy collision phenomena, strange particle interactions, weak interactions, antibaryon phenomena, and multiple meson production. (D.E.B.)

Nuclear Properties

4971 NP-6555

Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab. THE DETERMINATION AND INTERPRETATION OF NUCLEAR RADII BY NEUTRON SHAPE ELASTIC SCATTERING (thesis). Technical Report No. VIII [on] PRECISION SCATTERING OF NUCLEAR PARTICLES. Kamal Kishore Seth. Aug. 1957. 159p. Project NR-022-068. Contract N7onr-32505.

The concept of the nuclear radius is examined and its definitions are presented. The various nuclear models are studied and the optical model is examined in some detail. A brief description of the experimental apparatus and technique of measuring total cross sections is presented. The theoretical basis of the experiment and the methods of analysis of data are developed. Results and conclusions of experiments based on measurements of total cross sections by means of transmission studies on normal isotopic mixtures of Zn, Y, Zr, Nb, Mo, Ag, Sn, Ba, Nd, Sn, Ta, Au, Tl, Pb, Bi, Th, and U are presented. The results of these experiments are discussed, similar results on nuclear radii from other experiments are reviewed, and correspondence between the divergent results of these various investigations is established in view of current theories of nuclear structure. (For preceding report see NP-6150.) (M.H.R.)

4972 AEC-tr-3121

DISINTEGRATION OF Y^{90}. THE TRANSITION $0^+ \rightarrow 0^+$. I. TRANSITION $0^+ \rightarrow 0^+$ IN Zr^{90}. T. Yuasa, J. Laberrigue-Frolow, and L. Feuvrais. Translated by Robert M. Kloepper and Gretchen R. Riese from J. phys. radium 18, 498-504 (1957). 15p.

The observation of internal conversion electrons and of a spectrum of positrons which correspond to the decay of 1.73 Mev and whose intensities and energies are in good agreement with the theoretical data, the absence of corresponding γ radiation and the existence of annihilation radiation confirms the existence of a $0^+ \rightarrow 0^+$ transition in Zr^{90}. The absence of γ rays below 1.73 Mev confirms the hypothesis that this state is the first excited state. The experimental values of ρ^2 which are cited for $0^+ \rightarrow 0^+$ seem to us of the same order of magnitude, but the matrix elements increase with A. The values of ρ^2 for the EO(J = 2) transitions estimated by Church and others are smaller than those for J = 0. (auth)

4973

THE COLLECTIVE MODEL OF NUCLEI. F. Villars (European Organization for Nuclear Research (CERN), Geneva, Switzerland). Ann. Rev. Nuclear Sci. 7, 185-230 (1957).

4974

GAMMA-GAMMA ANGULAR CORRELATIONS IN Ca^{43}, Hg^{200} AND Pb^{206}. Torsten Lindqvist (Inst. of Physics, Uppsala, Sweden). Arkiv Fysik 12, 495-517(1957).

An automatic apparatus for angular correlation measurements is described. The corrections for counter solid angle are experimentally determined. Gamma-gamma angular correlation measurements determine the spins of two excited levels in Ca^{43} and three excited levels in Hg^{200} In Pb^{206} spins of five excited levels, given by Alburger and Pryce are verified. Triple correlations are used in two cases. (auth)

4975

QUADRUPOLE MOMENT OF Nb^{93} AND TEST OF THE HYPERFINE STRUCTURE FORMULAS. Kiyoshi Murakawa (Univ. of Tokyo). J. Phys. Soc. Japan 13, 101-8(1958) Jan.

The hyperfine structure (hfs) of the spectrum of Nb I was studied by means of a liquid air-cooled hollow cathode discharge tube and a Fabry-Pérot etalon. The quadrupole moment of Nb^{93} was deduced to be -0.29 barn and -0.20 barn (1 barn = 10^{-24} cm^2) from the levels $4d^35s^2\ {}^4F_{9/2}$ and $4d^45s\ {}^6D_{9/2}$, respectively, in which no shielding correction is included. Assuming that the shielding correction in this case is zero, $Q(Nb^{93}) = -0.2_8 \pm 0.1_8$ barn. The interval factors of the levels $4d^35s^2\ {}^4F_{9/2}$, $_{7/2}$, $_{5/2}$, $_{3/2}$ and $4d^45s\ {}^6D_{9/2}$, $_{7/2}$, $_{5/2}$, $_{3/2}$ were measured and compared with hfs formulas, and a small but definite discrepancy was detected. (auth)

4976

NEW CAPTURE GAMMA RAY MEASUREMENTS. Nucleonics 16, No. 1, 85(1958) Jan.

Results of prompt γ-ray spectral measurements from thermal neutron capture in U^{238} are presented. (L.M.T.)

4977

WEAK COLLECTIVE EFFECTS IN THE NUCLEAR SHELL MODEL. R. D. Amado (Clarendon Lab., Oxford, Eng.). Phys. Rev. 108, 1462-72(1957) Dec. 15.

Configuration mixing between the odd particle and the core is formulated to account for the weak collective quadrupole effects near closed shells. The configuration mixing sum is evaluated formally for the general case and applied to O^{17}. An equivalent formalism in which closure is done over the configuration mixing sum is developed and applied to O^{17}, giving good agreement with experiment. The closure result is found to be very insensitive to variation of parameters. The closure formalism is also applied near the lead closed shell, using a nuclear charge density distribution for the core instead of a sum over particle states. The collective effects in this region are well accounted for, and the formalism is compared with that for weak surface coupling. (auth)

4978

ENERGY LEVELS IN B^{10} IN THE REACTION $Li^6(\alpha,\gamma)B^{10}$. Luise Meyer-Schützmeister and S. S. Hanna (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1506-11 (1957) Dec. 15.

The yield of the reaction $Li^6(\alpha,\gamma)B^{10}$ was measured as a function of bombarding energy from 0.7 up to 3.8 Mev. Five levels in B^{10} were found at excitation energies of 4.77, 5.11, 5.16, 5.91, and 6.02 Mev. Only the levels at 4.77 and 5.16 Mev have been observed previously in this reaction. Resonance widths, cross sections, branching ratios, and angular distributions are given for the levels. Spin assignments of 2^+ (or possibly 3^+) to the 4.77-Mev level and 4^+ to the 6.02-Mev level are indicated by the evidence. For the other levels many spins are ruled out but definite assignments cannot be given. (auth)

4979

NUCLEAR SPINS AND MAGNETIC DIPOLE MOMENTS OF 50-DAY In^{114m} AND 54-MIN In^{116m}. L. S. Goodman and S. Wexler (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1524-6(1957) Dec. 15.

The nuclear spins and moments of 50-day In^{114m} and 54-min In^{116m} were measured in an atomic beam magnetic resonance apparatus. The spins were 5$\hbar$ for both nuclides. Magnetic moments of 4.7 ± 0.1 nuclear magnetons for In^{114m} and 4.4 ± 0.1 nm for In^{116m} were obtained. Both moments are shown to be positive. Multiple-quantum transitions were observed, and their effect on the accuracy of the results is discussed. (auth)

4980

INVESTIGATION OF THE ENERGY LEVELS OF THE F^{20} NUCLEUS BY MAGNETIC ANALYSIS. L. M. Khromchenko (Academy of Sciences, USSR). Soviet Phys. JETP 5, 231-4 (1957) Sept.

The products of the reaction $F^{19}(d,p)F^{20}$ were studied by applying the magnetic analysis method. In the investigated excitation energy range (up to 6.75 Mev) 24 proton groups were recorded which determine the ground state and 23 excitation levels of the F^{20} nucleus. Six of these levels, with excitation energies 4.55, 4.86, 5.41, 5.54, 6.07, and 6.36 Mev, have not been observed previously. The $E^* = 6.74$ Mev level in the (d,p) reaction has likewise been observed previously, but the relatively close F^{20} level has been detected in investigations on resonance scattering of neutrons. (auth)

4981

CONCERNING EVEN-EVEN NUCLEI HAVING THE CHARACTERISTIC 2+ FOR THE SECOND EXCITED STATE. N. N. Deliagin and V. S. Shipnel' (Moscow State Univ.). Soviet Phys. JETP 5, 309-10(1957) Sept.

4982

QUASI-MAGNETIC INTERACTION OF THE SPIN OF A NUCLEON WITH THE ROTATION OF THE NUCLEUS. D. F. Zaretskii and A. V. Shut'ko. Soviet Phys. JETP 5, 323-5(1957) Sept.

4983

AN INVESTIGATION OF THE EQUILIBRIUM FORM OF ATOMIC NUCLEI. B. L. Birbrair (Gertsen Leningrad State Pedagogical Inst.). Zhur Eksp. Teoret. Fiz. 33, 1235-47(1957) Nov. (In Russian)

The abrupt transition from the spherical equilibrium form of atomic nuclei to the ellipsoidal form is explained by the influence of pair interaction of nucleons. If the difference between pair energies in the ellipsoidal and spherical states is evaluated from experimental data on the binding energies of the nuclei, then the theoretical regions of prolate nuclei coincide with those observed in experiment. (tr-auth)

Nuclear Reactors

4984 AECU-3596

General Atomic Div., General Dynamics Corp., San Diego, Calif.

CALCULATION OF EFFECT OF FUEL BURNUP ON FUEL AND POISON DISTRIBUTIONS AND ON FLUX DISTRIBUTION IN THE MARINE REACTOR. George Hinman. Jan. 29, 1957. 25p. Project 16. Contract AT(04-3)-118. (GAMD-57). $0.75(OTS).

The changes in fuel and poison distributions and the changes in flux shape which accompany the consumption of fuel are studied. The technique employed is a perturbation calculation based on a one-velocity group treatment of the neutrons. The geometry is a spherical core surrounded by an infinite reflector. The programming forms for the IBM-650 which performs the computations using the Wolontis interpretative system are included. Two sample calculations were worked out using the code described and the results are plotted. (M.H.R.)

4985 AERE-C/R-2391

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DISTILLATION OF LIQUID METAL (BISMUTH) REACTOR FUEL. F. S. Martin and R. E. Brown. Sept. 1957. 18p.

The distillation of Bi from alloys containing Mg, Zr, U, and fission products was studied at temperatures up to 900°C. It is shown that Cs and Mg may be extensively removed with the Bi. The reactive fission products and the fuel remaining in the U-rich residue form slags; consequently it is not thought that distillation could play a useful part in the continuous processing of a liquid metal fuelled reactor based on Bi. It is suggested that distillation of the Bi would provide a useful head-end treatment before complete conversion of the U for the removal of noble fission products. (auth)

4986 AERE-R/R-2365

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF TURBULENT DIFFUSION ON TEMPERATURE TRANSIENTS IN LIQUID METAL FUEL REACTOR PIPELINES. J. J. Thompson. Sept. 1957. 14p. (LMFS/P-14).

A diffusion coefficient was calculated for a description of the turbulent diffusion of heated fluid in cylindrical pipes of diameters appropriate to liquid metal fuel reactors utilizing Bi. From the transfer function resulting from the solution of the diffusion equation, the attenuation of sharp edged transients and the damping of oscillations were calculated to illustrate the magnitude of the effect, and to assist in studies of the over-all control and operation problem of liquid metal fuel reactors. (auth)

4987 AERE-RP/R-2031(Suppl. 1)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EFFECTIVE CROSS SECTION DATA FOR THERMAL REACTOR CALCULATIONS. C. G. Campbell and R. G. Freemantle. July 1957. 6p.

The tables given, which contain additional data, amendments, and an extended temperature range, supersede those of AERE-RP/R-2031. (auth)

4988 ANL-5653

Argonne National Lab., Lemont, Ill.

DEVELOPMENT OF ULTRASONIC TECHNIQUES FOR INSPECTING EXPERIMENTAL BOILING WATER REACTOR CAST URANIUM ALLOY CORES AND FUEL PLATES. W. N. Beck and W. J. McGonnagle. Dec. 1957. 31p. Contract W-31-109-eng-38. $1.00(OTS).

An ultrasonic test technique was developed for the inspection of fuel plates, uranium alloy cores, and fuel plates in subassemblies for the Experimental Boiling Water Reactor (EBWR). For these tests a special scanner was designed and fabricated. The equipment could serve as a research tool as well as being used for inspecting numerous items of diversified lengths and shapes. A transmission technique was used at an ultrasonic frequency of 5 megacycles. The mechanical motion of the inspecting transducers was synchronized to a helix recorder so as to provide a permanent two-dimensional recording on electrosensitive paper. It was possible to detect piping, shrink, porosity, inclusions and microinclusions in the uranium alloy castings. In the completed fuel plates, a nonbond area of $\frac{1}{8}$ of an inch in diameter could be located. With the construction of a special two-arm probe, fuel plates installed in subassemblies were successfully tested by a transmission technique. (auth)

4989 APAE-MEMO-6(Del.)

Alco Products, Inc., Schenectady, N. Y.

THERMAL ANALYSIS OF APPR-1 AT MIDLIFE. C. G. Johnson. Jan. 2, 1956. 15p. Contract AT-(11-1)-318. $3.30(ph OTS); $2.40(mf OTS).

The calculated margin between peak surface temperature and the saturation temperature corresponding to a pressure of 1200 psia were determined. In order to meet the design objective of no surface boiling in steady state operation, the maximum surface temperature is limited to less than the saturation temperature. The design limit occurs at a hot spot location. This location is determined by applying

various factors to the thermal conditions in an average or nominal channel to create a "hot channel." The hot channel is a statistical entity determined by the most pessimistic combination of all flux factors. (auth)

4990 APAE-Memo-70
Alco Products, Inc., Schenectady, N. Y.
RESONANCE SELF-SHIELDING FOR HYDROGENOUS REACTOR. Raymond L. Murray. Dec. 4, 1956. 11p. Contract DA-44-009-Eng-2868.

A correction factor to apply to the macroscopic absorption cross section of U^{238} in the resonance region for a heterogeneous hydrogen-moderated reactor is derived and used in a sample calculation. (M.H.R.)

4991 APAE-Memo-74
Alco Products, Inc., Schenectady, N. Y.
GEOMETRIC FACTORS FOR RESONANCE CAPTURE IN CYLINDRICAL FUEL ELEMENTS. Raymond L. Murray. Dec. 6, 1956. 21p. Contract DA-44-009-Eng-2868.

As a part of the analysis of self-shielding in the resonance energy range for heterogeneous reactors, it is necessary to know the average probability that a neutron scattered in the moderator will strike adjacent fuel plates. This report serves to present a derivation and working formulas for this quantity. The case of parallel infinite cylinders in a regular lattice arrangement is examined. (auth)

4992 APAE-Memo-82
Alco Products, Inc., Schenectady, N. Y.
METHODS FOR CALCULATION OF THERMAL MULTIPLICATION CONSTANT, RESONANCE ESCAPE PROBABILITY AND FAST FISSION FACTOR FOR LOW ENRICHMENT REACTORS. B. J. Byrne. Jan. 25, 1957. 48p. Contract DA-44-009-Eng-2868.

Methods used for the calculation of thermal multiplication constant, resonance escape probability, and fast fission factor for a low enrichment reactor are described. These parameters are used in a modified two-group calculation of the effective multiplication constant. Previously, a homogeneous model was used for calculation of these parameters. The methods presently being used incorporate the effect of heterogeneity into the calculation of thermal multiplication constant and resonance escape probability. The fast fission factor is still calculated on the basis of a homogeneous model, but a new correlation has been chosen which gives a better fit to available experimental data. (auth)

4993 CF-57-8-30(Rev.)
Oak Ridge National Lab., Tenn.
NUCLEAR CONSIDERATIONS IN DESIGN OF HIGH-TEMPERATURE PROCESS-HEAT REACTORS. J. T. Roberts. Dec. 11, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A qualitative discussion of how neutronics may affect the design of high-temperature process-heat reactors in ways other than might be anticipated from rules of thumb based on experience with low-temperature, thermal reactors is presented. The chemical and engineering problems of constructing, operating, and reprocessing high-temperature reactors are, for the most part, given only passing mention, although an effort was made to emphasize moderators and absorbers which are available in ceramic form. (auth)

4994 CF-57-12-1
Oak Ridge National Lab., Tenn.
TIME-DEPENDENT STUDIES OF THE NUCLEAR CHARACTERISTICS OF HRE-3. Melvin Tobias, M. W. Rosenthal, and T. B. Fowler. Dec. 31, 1957. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A method has been devised for examining the build-up of higher isotopes and fission-product poisons in two-region thorium breeder reactors assuming operation at constant power (rather than constant flux). This procedure has been employed to study seven reactors of the HRE-3 type, four of which are assumed charged with U^{233} fuel originally, and three of which are fueled with U^{235} at the start. The principal conclusions drawn from this study were the following: (1) Reactors fueled with U^{233} display a steady drop in breeding ratio which is interrupted sharply by initiation of core processing; (2) Reactors fueled with U^{235} show a much more constant, but lower, breeding ratio over comparable time intervals; (3) All the cases show a remarkable constant critical fuel concentration in the core; (4) The build-up of higher uranium isotopes in the core is quite slow and periods of the order of 10 years or longer are required for the total core uranium concentration to approach equilibrium levels; (5) Build-up of blanket isotopes is also slow and Pa^{233} builds up to equilibrium levels rapidly, usually well before initiation of chemical processing. Calculation of critical concentrations and breeding ratios was performed using a two-group, two-region spherical reactor code. The accuracy of the results is subject to the well-known limitations of this procedure. It is noted that no account has been taken of the poisoning effect of corrosion products, which may be considerable. (auth)

4995 CF-58-1-79
Oak Ridge National Lab., Tenn.
TWO-GROUP CONSTANTS FOR AQUEOUS HOMOGENEOUS REACTOR CALCULATIONS. T. B. Fowler and M. Tobias. Jan. 22, 1958. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A set of constants which have been used in two-group calculations for aqueous homogeneous reactors was compiled. Included are: thermal microscopic absorption and fission cross sections for various elements and various temperatures; thermal macroscopic absorption cross sections for H_2O, D_2O, and Zr, and the density of H_2O and D_2O; values of η and ν for U^{233}, U^{235}, Pu^{239}, and Pu^{241}; τ, D_1, D_2 and p as functions of Th^{232} concentration in ThO_2–D_2O mixtures; and values of τ, D_1, D_2, and p at 280 and 330°C as functions of U^{238} concentration in solutions. (M.H.R.)

4996 CREL-737
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
NRU THERMAL POWER CONTROL. A. Pearson and C. G. Lennox. Sept. 1957. 55p. (AECL-506).

Throughout the design of the NRU control system the term neutron power was used in the sense that the ion chamber amplifiers which measure neutron flux at fixed positions about the reactor are calibrated to read the power measured by conventional temperature rise-flow methods. For reasons discussed this calibration varies considerably with conditions in the reactor so that control by neutron flux alone results in variations in the true thermal power produced by the reactor. Pearce shows in fact that a 40% variation in power is possible. To relieve the operator of the necessity for continual re-adjustment of the measured neutron flux level to maintain constant power an automatic system has been developed. The system provides not only for steady power control but insures that the reactor is brought safely up to the required power level under all conditions. The control system is described in detail and the various stages leading to its present form are outlined. (auth)

4997 IDO-16368
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

HYDRAULIC FLOW CALCULATIONS FOR MTR-ETR EXPERIMENTS; STANDARD PRACTICES MANUAL. R. B. VanSice, ed. Nov. 1, 1957. 69p. Contract AT(10-1)-205. $2.00(OTS).

Recognizing the need for uniform methods of making hydraulic calculations, Phillips Petroleum personnel have compiled typical examples of hydraulic flow calculations. These examples and methods of calculation have been reviewed by the Phillips Reactor Safeguard Committee and approved as standard methods to be used in future hydraulic problems pertaining to experimental work at the MTR and ETR. (auth)

4998 IDO-16416

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTOR PROJECTS BRANCH QUARTERLY PROGRESS REPORT [FOR] JULY, AUGUST, SEPTEMBER 1957. G. O. Bright, ed. Oct. 1, 1957. 84p. Contract AT(10-1)-205. $2.25(OTS).

Spert-I- A brief résumé of "A" core experiments is presented and the results of some of the static measurements with the "B" core are shown. It was found that four usable cores are possible with the removable-plate "B" fuel assemblies. The measurements made to date have been with a 24 fuel plate/assembly, 32 assembly core, and include rod worth, flux distribution, temperature coefficient and preliminary void coefficient studies. Spert-II- The construction contract was let and construction started in August. Spert-III - The control system circuit drawings are essentially complete. Data Reduction and Interpretation- The progress made in reducing the large raw data backlog from the Spert I "A" core experiments is shown. Work is continuing on the calculation of reactivity behavior during a transient, with the principal area of investigation being that of a boiling or slightly subcooled experiments. The use of other calculational procedures as a check on the reactivity behavior work is being investigated. Theoretical- The critical masses for the various possible "B" cores were calculated, and agree quite well with the experimentally determined values. Some machine calculations of the temperature and void effect with the 32 assembly core were made, but no direct comparison with empirical values is yet possible. Two theoretical formulations, one a refinement of the Fuchs' model for reactor self-shutdown which seeks to explain the initial reactor transient behavior, and one which endeavors to show that the shutdown mechanism for reactor periods longer than 50 msec can be ascribed to moderator density changes, were evolved. Instrumentation- The primary activities of the Instrumentation section were directed toward completion of all modification, maintenance, installation, and calibration of instrumentation necessary for performing static and transient tests on the Spert-I "B" core. Engineering- Various modifications were made of the Spert-I reactor, including a new mechanism for clamping the fuel assembly in the core. Corrosion studies on Al were made for the Spert-I and Spert-II cores. A program is underway to determine a suitable control rod construction for Spert-II. Flow tests were made on Spert-II and Spert-III fuel assemblies. A complete description of the Spert-III control rod test facility is given. The results of the tests which have been made in this facility show that the present design of the Spert-III control rods and drives is satisfactory. An engineering completion schedule is given for both Spert-II and Spert-III. (For preceding period see IDO-16415.) (auth)

4999 IP-228

Michigan. Univ., Ann Arbor. Coll. of Engineering.

NUCLEAR TANKER ECONOMICS. Harry Benford. July 1957. 69p.

Useful information relative to nuclear tanker costs is presented. The estimation of probable upper and lower limits for the various operating costs such as crew wages, repairs, and insurance is included. Typical calculations, presented in detail, show methods by which the data can be put to use in nuclear tanker cost studies. (M.H.R.)

5000 KAPL-M-SMS-84

Knolls Atomic Power Lab., Schenectady, N. Y.

S3G/S4G HIGH TEMPERATURE PURIFICATION WITH AN AXIAL BED FILTER. H. G. Richardson and R. E. Larson. Jan. 6, 1958. 59p. Contract W-31-109-Eng-52. $9.30 (ph OTS); $3.60(mf OTS).

Attached to this report is a letter containing pertinent information by P. R. Matthews, dated Jan. 20, 1958. 2p.

The investigation of a magnetic-magnesia or magnetite-Mg axial flow bed filter for high-temperature purification of S3G/S4G primary coolant included the following studies: four out-of-pile tests of the hot bed filter, determination of the solubility of MgO up to 626°F in a stainless steel autoclave, two in-pile tests at the MTR site, and comparison of hot bed filter performance with expected ion exchange performance in S3G. The following conclusions are drawn: neither MgO nor Mg metal is suitable for maintaining high pH conditions in primary coolant water at S3G operating temperatures; except for maintaining the S3G reference pH, use of magnetite alone in the S3G coolant demineralizer would provide the requisite purification for normal operation of the plant; fission product removal was not conclusively analyzed, but the indications are that the bed filter does not perform as well as ion exchange. (M.H.R.)

5001 NAA-SR-1955

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A FURTHER EVALUATION OF THE CALDER HALL TYPE OF NUCLEAR POWER PLANT. W. F. Banks. June 28, 1957. 52p. Contract AT(11-1)-GEN-8. $1.50(OTS).

This study is a continuation of the work reported in NAA-SR-1833.

The results of plant optimization studies and cost estimates of the reference design for a natural U, graphite moderated, gas-cooled reactor and power plant which was described in NAA-SR-1833 are presented. Additional engineering drawings are included, some of which were required because of changes in turbine plant and others for estimating purposes. A construction cost estimate of $70 million for a 165 eMw plant is presented in detail, leading to power costs of approximately 14 mils/kwh, assuming private utility operation in the United States. (auth)

5002 NAA-SR-2004

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE EXPERIMENTAL DEVELOPMENT OF A FUEL HANDLING SYSTEM FOR THE SODIUM REACTOR EXPERIMENT. W. J. Hallett and J. A. Leppard. Jan. 15, 1958. 48p. Contract AT(04-8)-49. $1.50(OTS).

A fuel handling system was developed from concepts based on early design studies of Na cooled, graphite moderated reactors. The development program, the evolution of design leading to the construction of the SRE refueling cask and the tests performed on a mock-up of the equipment are described. Because of the conditions encountered, a rather detailed chronological account is given of the experimental development. Emphasis is placed on the difficulties which arose and the specific means utilized to overcome them. The equipment and procedure available at the conclusion of the development effort would permit removal and replacement of a fuel element in the SRE

core in about 54 min. The amount of Na carried over by a spent fuel element was found to be between 0.1 and 0.25 pounds. Sodium transferred in the gas phase during the fuel replacement process was found to be of the order of a few micrograms. Reliable provisions were evolved for all steps of the operation, including locating the fuel handling cask, sealing the cask and reactor atmospheres, connecting with the cleaning cell and washing down the removed element. (auth)

5003 NAA-SR-2058

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR PHYSICS QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1957. M. Carl Walske, ed. Jan. 15, 1958. 8p. Contract AT-11-1-GEN-8. $0.50(OTS).

The transport mean free path of thermal neutrons in diphenyl was measured by the B poisoning method to be 0.80 ± 0.05 cm. This permits calculation of the horizontal buckling for the U rod lattices in the 2¼-foot-diameter tank, the result being 47.5 ± 0.1 m^{-2}. This leads to values of 1.3 ± 0.9 and 17.8 ± 0.5 m^{-2}, respectively, for the bucklings of the natural (0.72%) and enriched (0.91%) U lattices for which the diphenyl moderator-to-fuel volume ratio is 4. Scintillation equipment is being set up to replace the Geiger counters at present in use for activation analysis. The scintillation equipment is also being adapted for use in resonance escape and fast-effect measurements. (For preceding period see NAA-SR-1974.) (auth)

5004 NAA-SR-Memo-564

North American Aviation, Inc., Downey, Calif.

PLUTONIUM CONTRIBUTIONS TO EFFECTIVE FUEL BURN-UP. E. F. Weisner. Jan. 6, 1953. 6p. $1.80 (ph OTS); $1.80(mf OTS).

In the design of reactors for the production of power only and in the cost analyses on such reactors, it is necessary to be able to estimate the life of the fuel charge or the fraction of the fuel that can be burned up per pass. Additional information is needed in the amount of Pu produced after a given irradiation and its effect in contributing to the Mwd/t. This information is presented in curves. (auth)

5005 NAA-SR-Memo-748

North American Aviation, Inc., Downey, Calif.

START-UP INCIDENT IN 30 MW SGR. J. E. Garvey. July 29, 1953. Decl. Oct. 16, 1957. 12p. $3.30(ph OTS); $2.40(mf OTS).

A possible start-up incident in the 30 Mw SGR is analyzed. The calculations are performed on the AER-Differential Analyzer. Curves so obtained showing relative power, fuel rod energy density, and reactivity are presented for two values of control rod withdrawal speed. A withdrawal speed corresponding to a positive increment 1.5×10^{-4} r/sec (1r = 1 dollar) results in fuel rod melting being attained about 40 sec after prompt criticality is reached. (auth)

5006 NAA-SR-Memo-1110

North American Aviation, Inc., Downey, Calif.

SGX LATTICE CONSTANTS AND REACTIVITY. F. L. Fillmore. Sept. 28, 1954. 9p. $1.80(ph OTS); $1.80 (mf OTS).

Lattice constants for the Na graphite exponential assemblies using 2.75% enriched U are calculated by the same procedures employed in the calculation of the SRE lattice constants. The method was described in detail in NAA-SR-Memo-1021 and is not repeated here. The reactivity of each of the three proposed SGX lattices is obtained, and it is seen that all are substantially sub-critical. (auth)

5007 NAA-SR-Memo-1402

North American Aviation, Inc., Downey, Calif.

PRESENTATION OF THE SODIUM GRAPHITE REACTOR TO INSURANCE UNDERWRITERS, JUNE 15, 1955. July 22, 1955. 65p. Contract AT(04-3)-49. $1.75(OTS).

Topics covered are: general description, plant layout, and performance data; some nuclear aspects and induced activities; the conventional power plant, control scheme and manpower; the plan of operation of the SGR plant; safety considerations; and nuclear incidents–probabilities and consequences. (M.H.R.)

5008 NAA-SR-MEMO-1430

North American Aviation, Inc., Downey, Calif.

CONSIDERATION OF GRAY CONTROL RODS FOR SODIUM-GRAPHITE REACTORS. Oscar D. Seawell. July 12, 1955. Decl. Oct. 16, 1957. 5p. $1.80(ph OTS); $1.80 (mf OTS).

The characteristics of gray control rods are discussed, with particular reference to effects on specific power and operation of the SRE. An experimental program is recommended for the SRE, consisting of purchasing and testing the operation of gray control rod rings made of low cross section high temperature material having no boron content. An analytical program is recommended for the SGR, consisting of a study of the effect of control rod grayness on the specific power of the reactor. (auth)

5009 NP-6539

[Gt. Brit. Windscale Works, Sellafield, Cumb., England.]

ACCIDENT AT WINDSCALE NO. 1 PILE ON OCTOBER 10, 1957. Nov. 1957. 26p.

This report to Parliament contains the following: a memorandum by the Prime Minister, the reports of the committee of inquiry on the cause of the accident and the measures taken to deal with it and the measures taken to deal with the consequences of the accident, the report to the Medical Research Council on health and safety aspects, a memorandum by the chairman of the United Kingdom Atomic Energy Authority, a note by the UKAEA on the Calder Hall and civil power reactors, and the terms of reference and membership of the committees referred to in the Prime Minister's memorandum. (M.H.R.)

5010 NP-6543

MSA Research Corp., Callery, Penna.

ACTIVITY ASSOCIATED WITH PARTICLE SIZE FOUND IN A SAMPLE OF S1W CRUD. Technical Report No. 61. C. A. Palladino and E. F. Batutis. Jan. 22, 1958. 15p. Contract NObs-65426.

A radioactive crud sample taken from a drain leg deposit in the S1W system was analyzed for particle size distribution by separation into particle size ranges. Elutriation, sedimentation and filtration were used and the separated portions analyzed for specific activity by several methods. The volume mean diameter of the crud was 27.6 microns, with 90% of the mass in the 9–48 micron range. Volume mean diameter of the particles above 12 microns was 19.7 microns. Specific activity of the material in size ranges 0–5 microns, 5–10 microns, etc., was constant to within ± 30% of the average for all size ranges. Co^{60} was the only isotope found, giving an average specific activity of 4.8×10^6 dpm/mg. Selective filtration was used to separate particles below 1 micron, where the specific activity was found to increase by factors of ten in the sizes below 0.45 microns; contribution to the total weight of crud by this size range is minute, and the over-all crud activity is not appreciably affected. It does indicate a longer residence time for the smaller particles in the stream. (auth)

5011 NRDC-29

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE NEUTRON SPECTRUM IN LIGHT WATER MODERATED REACTORS. P. W. Mummery, P. A. Egelstaff, and J. H. Tait. Sept. 30, 1953. 5p.

Some ways in which information may be gained on the influence of the molecular binding on the neutron spectrum near the Pu resonances are considered. Four possible modes of attack considered are direct measurement of the neutron spectrum, fundamental measurements regarding the scattering process, and integral experiments. (L.T.W.)

5012 NYO-6480

New York Univ., New York. Atomic Energy Commission Computing Facility.

STEADY STATES, BOUNDEDNESS, AND NUMERICAL ANALYSIS OF TEMPERATURE AND NEUTRON DENSITY IN CIRCULATING FUEL REACTORS. Herbert B. Keller and Joel Franklin. July 1, 1955. 26p. Contract AT(30-1)-1480. $0.25(OTS).

A system of non-linear partial differential equations for the neutron density and temperature in a circulating fuel reactor is studied. A steady-state solution of these equations is obtained together with conditions which guarantee its existence and uniqueness. Further conditions are obtained which are sufficient to insure the boundedness of the temperature for all time. Explicit bounds are obtained when the excess multiplication factor is a linear function of temperature. A numerical method for the solution of the non-linear equations is presented. This procedure is shown to be stable and convergent under stated conditions on the mesh. (auth)

5013 TID-7548

Argonne National Lab., Lemont, Ill., Los Alamos Scientific Lab., N. Mex., and Power Reactor Development Co., Detroit.

FAST REACTOR PROGRAM INFORMATION MEETING, CHICAGO, ILLINOIS, NOVEMBER 20-21, 1957. Summaries of Papers. Nov. 20, 1957. 53p. $1.50(OTS).

Papers are presented on: the ANL, LASL, and PRDC fast reactor programs; the engineering design of the Experimental Breeder Reactor-II- the reactor and power cycle and the fuel process and fabrications cycle; the design of the Enrico Fermi atomic power plant; fast reactor safety in the EBR-I; meltdown and analysis; and analysis of prompt excursions in simple systems, reactor design and analysis of LAMPRE I, EBR-II, and the Enrico Fermi Reactor; nuclear analysis by critical experiments with ZPR-III and static analysis; fuel element design; the EBR-II fuel cycle–fuel cycle plant and process and remote fuel element fabrication and processing; irradiation and thermal stability; Na technology, pumps, and piping system components; heat exchangers and steam generators; high purity Na systems; advanced Pu reactor concepts; fluid fuels; Pu–U alloy metal systems; fuel element concepts; fuel and blanket process development; and a coupled fast-thermal reactor. (M.H.R.)

5014 UK/C/6/101

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

REVIEW OF LOOP PROGRAMME IN THE NRX REACTOR. [Paper Presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. R. F. S. Robertson. Sept. 1957. 24p.

The over-all loop program is reviewed briefly. Results obtained from investigations of the corrosion of mild and stainless steels in these loops and some conclusions reached regarding the activation and distribution of activated corrosion products around a loop system are discussed. The escape and distribution in the loop circuit of fission products from defected UO_2 fuel rods under irradiation are discussed. (auth)

5015 WAPD-PWR-CP-3130

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

TRITIUM CONCENTRATIONS IN THE PWR SECONDARY SYSTEM. R. Lloyd. 11p. [June 1957]. $3.30(ph OTS); $2.40(mf OTS).

The "worst case" tritium contamination of the secondary system of PWR was calculated. It is assumed that a boiler tube leak occurs which lets flow into the secondary side of the boilers 10 gph of pH 10.5 primary coolant containing 4 μc/ml tritium. In the event of such a leak, the tritium concentration on the shell side of the boilers, in the high-pressure steam line, in the hot well, and in the steam service and heating system will reach a steady-state value of 0.13 μc/ml in about 2 weeks. The reactor plant storage tank will likewise reach a steady-state tritium concentration of 0.13 μc/ml, but at the end of about 3 months. The turbine plant storage tank will level off at a tritium concentration of 0.05 μc/ml in about 2 months. If the primary coolant is maintained, as expected, at the normal operating pH of 10.0, the primary coolant tritium concentration will be only 1.26 μc/ml. If under these conditions a 10 gph boiler tube leak occurs, the tritium concentrations in the secondary system locations will rise to only about a third of the values given above. In particular, the steam service and heating system, which is the only part of the secondary system that may be expected to present a personnel hazard, will reach a steady-state tritium concentration of about 0.04 μc/ml, which exceeds 1/10 Handbook 52 tolerance by a factor of only 2. For this same leakage rate, the fission product activity in the steam service and heating system will exceed 1/10 Handbook 52 (Table III) tolerance by a factor of 12. Thus the relative hazard due to tritium contamination in the secondary system will be less than that due to fission product contamination. (auth)

5016 WAPD-PWR-Ph-186(Apps. A and B)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

APPENDIX A. NUCLEAR DESIGN INFORMATION PROVIDED FOR CORE THERMAL PERFORMANCE ANALYSES. M. J. Galper. May 25, 1957. APPENDIX B. P. S. Lacy. June 20, 1957. 9p. $1.80(ph OTS); $1.80 (mf OTS).

Techniques used in establishing power distribution information to be used for the analysis of Shippingport Pressurized Water Reactor thermal performance are described, and a summary of the limitations of that information is given. No justification of the model used is attempted. The calculations for spatial distribution of power in the reactor are based on the assumption that separability of axial from radial variations in neutron flux can be treated independently. The results of the latest gross radial power distribution study are reported. (M.H.R.)

5017 WAPD-PWR-Ph-243

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ANALYSIS OF POSSIBLE POWER EXCURSIONS ON ALUMINUM ALLOY FUELED PWR MOCK-UP. W. H. Hartley. Nov. 1957. 10p. $1.80(ph OTS); $1.80(mf OTS).

The possibility of fuel element damage for a reactor fueled with an Al–U alloy fuel is investigated. The reactor considered is a mockup of PWR Core 1 using seed fuel in the form of a 20.6 wt. % enriched U–Al alloy. The analysis is based on that given in NRL-4495. This analysis assumes that the self shutdown mechanism is a vaporization of water by the heat produced in the fuel plates. The vaporization reduces the effective moderator density and hence the reactivity and terminates the excursion. This type of analysis was used in WAPD-SC-531 to demonstrate the adequacy of the self shutdown properties for the PWR mockup using a U–Zr alloy fuel. The results for the Al–U fuel indicate that for reactor periods as short as 2 milliseconds the maximum temperature in the fuel plates is below the melting point of the Al alloy (~660°C). (auth)

5018 WAPD-PWR-RD-229

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR FUEL ELEMENT FAILURE DETECTION SYSTEM. N. J. Palladino. May 22, 1956. Includes Appendix: GENERAL THEORY OF FUEL ELEMENT FAILURE DETECTION SYSTEMS. Paul W. Frank. 13p. $3.30(ph OTS); $2.40(mf OTS).

A modified system is presented, as the reference system (WAPD-PWR-RD-127) did not meet the design objectives of detecting and locating a failed element. (M.H.R.)

5019 WAPD-TM-53(Add. 1)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CANDLE—A ONE-DIMENSIONAL FEW-GROUP DEPLETION CODE FOR THE IBM-704. ADDENDUM 1. CANDLE 2. O. J. Marlowe and P. A. Ombrellard. Oct. 1957. 19p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The second version of CANDLE, CANDLE 2, differs from the first version as follows: provision for a two-group option, improvement in the fast cross-section library, modification of the input, additional output item, and change in operating instruction, including the program stops. (auth)

5020 WCAP-382

Westinghouse Electric Corp. Commercial Atomic Power Activity, Pittsburgh.

NEUTRON SOURCES FOR USE IN REACTOR STARTUP. Arthur B. de Saint Maurice. Nov. 14, 1956. 24p. $4.80 (ph OTS); $2.70(mf OTS).

The particular properties of the Westinghouse Testing Reactor are used in the design of the neutron sources to be used both in its startup and in the critical experiments. Specifically the WTR is a high flux irradiation facility using highly enriched U^{235} as fuel and light water as moderator and coolant. The amount of reactivity control is such that the shutdown multiplication is 0.85 under normal operating conditions. The sources considered are the $D^2(\gamma,n)H^1$ reaction, the $Be^9(\gamma,n)Be^8$ reaction, Sb–Be coaxial neutron source, Sb–Be homogeneous neutron source, and Po–Be mixture neutron source. Discussions are included on the selection of neutron source type, subcritical flux determination, neutron source specification for the WTR critical, neutron flux variation in the WTR, and neutron source containers. (M.H.R.)

5021 AEC-tr-3135

EFFECT OF CAVITIES ON THE CRITICAL MASS OF A SWIMMING POOL-TYPE REACTOR. B. P. Rastogi. Translated from Atomnaya Energ. 2, 417-19(1957). 9p.

5022

TESTING AIRCRAFT NUCLEAR POWER PLANTS. A. R. Crocker (General Electric Co., Cincinnati). Aeronaut. Eng. Rev. 16, 30-5(1957) Dec.

A discussion is given of the techniques, procedures, and restrictions which permit the accomplishment of a testing program in a complete and safe manner. (L.T.W.)

5023

AIRCRAFT SHIELD TEST REACTOR. J. C. Nance and L. W. Perry (Convair, Fort Worth, Tex.). Nucleonics 16, No. 1, 58-61(1958) Jan.

Design and description, cooling system, ground and flight testing, and handling and operation are described. (L.M.T.)

5024

PLUTONIUM RECYCLE TEST REACTOR. R. M. Fryar (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 16, No. 1, 62-3(1958) Jan.

The PRTR is part of a program to develop the technology of thermal heterogeneous power reactors using a Pu fuel cycle. The reactor was not selected as an optimum type for the Pu–fuel cycle, but as a facility for experiment and testing. (L.M.T.)

5025

REACTOR EXCLUSION AREAS—CAN THEY BE ELIMINATED? G. W. C. Tait (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Nucleonics 16, No. 1, 71-3(1958) Jan.

The author, after evaluating design vs. exclusion, concludes that by designing conservatively, reactors can be put where they are most useful without unusual public hazard. (L.M.T.)

5026

ELECTRICAL ANALOG SOLVES REACTOR DESIGN PROBLEMS. Shigeo Nagao (Tohoku Univ., Sendai, Japan). Nucleonics 16, No. 1, 88-90(1958) Jan.

An analog method is described for finding two-dimensional solutions for neutron diffusion, thermal conductivity, or Fermi age equations. (L.M.T.)

5027

WHAT PRICE REACTOR MATERIALS? Malcolm F. Judkins (Firth Sterling, Inc., Pittsburgh). Nucleonics 16, No. 1, 96-8(1958) Jan.

A composite list of selected reactor materials showing the form in which they can be procured and the current price in that form is presented. (L.M.T.)

5028

BORON STEEL FOR CONTROL RODS AND THERMAL SHIELDS. Nicholas Balai (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 1, 100-1(1958) Jan.

Advantages of using boron steel are emphasized from the standpoints of burnup, costs, and effectiveness. Typical mechanical and metallurgical properties are given. (L.M.T.)

5029

THE ENGINEERING TEST REACTOR—A STATUS REPORT. R. L. Doan (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics 16, No. 1, 102-5(1958) Jan.

Some of the problems revealed by test work to date on the ETR are discussed. (L.M.T.)

5030

THERMODYNAMICS OF GAS-COOLED REACTORS. Gilbert B. Melese. Nucleonics 16, No. 2, 72-6(1958) Feb.

A thermodynamic analysis of gas-cooled reactors in terms of simplified basic equations was made. The resulting expression for electrical power output can be written as a product of five factors: (1) outside variables, (2) nuclear quantities, (3) maximum can temperature, (4) dimensions and gas pressure, and (5) properties of the coolant gas. (J.S.R.)

5031

SAFETY OF MAGNESIUM CANNING FOR CO_2-COOLED REACTORS. Marc Salesse. Nucleonics 16, No. 2, 123-4 (1958) Feb.

The French CO_2-cooled reactor El underwent a series of temperature oscillations. When the four fuel elements were later removed, it was found that on two of the rods the Mg canning had partially melted. Molten Mg had flown away and later solidified around the melted area forming cushions and drops. The surface of the grooved U was undamaged. From these results it appears that commercially pure electrolytic Mg is a safe canning material in CO_2-cooled reactors. (J.S.R.)

5032

REACTORS ON THE LINE. VALLECITOS BOILING WATER REACTOR. Nucleonics 16, No. 2, 76a-f(1958) Feb.

The VBWR was put into operation on Oct. 17, 1957. The reactor produces 6,000 kw of electricity for industrial use.

The pressure vessel, core structure, fuel elements, control rods, and control-rod drives are described. (J.S.R.)

5033

SAFEGUARDS ASPECTS OF REACTOR VESSEL DESIGN. D. R. Miller and W. E. Cooper (Knolls Atomic Power Lab., Schenectady, N. Y.). Welding J. (N. Y.) 37, 22s-26s(1958) Jan.

The problem of design of power-reactor vessels for safety and durability requires careful application of existing industrial experience and engineering fundamentals to assure adequate consideration of the new problems which arise. Internal heat generation in structural materials, radiation-induced changes in mechanical properties, thermal shock and strain cycling, and coolant-dissociation effects on corrosion and embrittlement all present problems which require close attention. The hazards of mechanical failure and the cost and difficulty of repair place a high value on safety and reliability and justify comprehensive structural-design criteria and evaluation coupled with close control of material and fabrication quality. An uncommon problem associated with the pressure-vessel design is analysis of the consequences of conceivable accidents due to reactor runaway, or in some cases due to a nondetonating chemical reaction. In some cases a pressure-tight building is provided to prevent spread of radioactivity. The problem of penetration of the enclosure building by missiles from the pressure vessel then requires careful evaluation. (auth)

Nuclear Transformation

5034

COMPARISON BETWEEN EXPERIMENTAL AND THEORETICAL ANGULAR DISTRIBUTIONS OF SOME PROTON GROUPS FROM $B^{10}(d,p)B^{11}$ AND $O^{18}(d,p)O^{19}$. Bo Sjögren. Arkiv Fysik 12, 537-42(1957).

5035

PROTON ANGULAR DISTRIBUTIONS FROM THE REACTION $N^{14}(d,p)N^{15}$. Bo Sjögren and Katarina Ahnlund. Arkiv Fysik 12, 547-52(1957).

A bombarding energy of 8 Mev was used for an angular distribution study of the proton groups from the reaction $N^{14}(d,p)N^{15}$. A comparison is made with non-Coulomb stripping theories. (L.T.W.)

5036

ANGULAR DISTRIBUTION OF PHOTO-NEUTRONS PRODUCED BY 17 Mev X-RAYS. Tsunesaburo Asada, Masayoshi Masuda, Masayuki Okumura, and Juzo Okuma (Univ. of Osaka). J. Phys. Soc. Japan 13, 1-4(1958) Jan.

The angular distributions of photoneutrons from lead, copper, aluminum, and beryllium have been measured by using bremsstrahlung of maximum energy of 17 Mev from a betatron. The neutron detector is ZnS-paraffin-Lucite light guide button. The results are $1 + (1.29 \pm 0.53)\sin^2\theta$, $1 + (1.6 \pm 0.8)\sin^2\theta$, $1 + (0.17 \pm 0.06)\sin^2\theta$, $1 + (0.30 \pm 0.11)\sin^2\theta$ for beryllium, aluminum, copper, and lead. (auth)

5037

RADIATIVE PROTON CAPTURE BY Ni^{58}, Ni^{60}, AND Co^{59}. J. W. Butler and C. R. Gossett (U. S. Naval Research Lab., Washington). Phys. Rev. 108, 1473-95(1957) Dec. 15.

Thin targets of Ni^{58}, Ni^{60}, and Co^{59} were bombarded with protons from 700 to 1900 kev. Seventeen radiative capture resonances were observed for Ni^{58}; fifty-four resonances were observed for Ni^{60}; and about 150 resonances were observed for Co^{59}. Precise bombarding energies were determined for the nickel resonances, and are listed in tabular form. All resonances were narrower than 1 kev. The $\int\sigma(E)dE$ was measured for each of the nickel resonances. The following Q values were determined: $Ni^{58}(p,\gamma)Cu^{59}$, 3.42 ± 0.02 Mev; $Ni^{60}(p,\gamma)Cu^{61}$, 4.81 ± 0.03 Mev. The following low-energy cascade gamma rays were observed: Ni^{58}, 0.492 ± 0.005, 0.908 ± 0.020, 1.38 ± 0.03, 1.78 ± 0.02, 2.00 ± 0.04, and 2.32 ± 0.04 Mev; Ni^{60}, 0.468 ± 0.010, 0.96 ± 0.02, 1.30 ± 0.02, 1.38 ± 0.02, 1.63 ± 0.03, and 1.91 ± 0.03 Mev; Co^{59}, 0.47 ± 0.02, 0.84 ± 0.02, 0.95 ± 0.02, 1.07 ± 0.02, 1.17 ± 0.02, 1.33 ± 0.02, 1.64 ± 0.03, and 1.77 ± 0.03 Mev. Branching ratios to all states below 2 Mev were measured from several of the intense resonances in the nickel isotopes. The branching ratio measurements indicated that the low-energy member of each cascade in the nickel reactions, except possibly the 1.30-Mev gamma ray from protons on Ni^{60}, represented an excited state of the same energy; but indications for a 1.38-Mev state in Cu^{59} and a 1.63-Mev state in Cu^{61} were weak. Angular distribution measurements were made on some of the more intense resonances in the nickel isotopes, and unique spins were determined for those resonant states and for the first excited state of Cu^{59}. For the states whose spins were measured, probable parity assignments have been made. Reduced proton widths have been determined for the resonances below a bombarding energy of 1300 kev. The matrix elements for the several E1 and M1 transitions are compared with previous tabulations. Several new experimental techniques are discussed. (auth)

5038

FORMATION OF Cd^{115} ISOMERS IN HIGH-ENERGY FISSION OF BISMUTH. Norbert T. Porile (Univ. of Chicago, Ill.). Phys. Rev. 108, 1526-30(1957) Dec. 15.

The relative yields and recoil properties of the Cd^{115} isomers independently formed in the 450-Mev proton fission of bismuth have been measured. The 43-day Cd^{115m} isomer has a higher yield and smaller range than the 53-hr Cd^{115}. Cd^{115m} is also formed in a higher deposition energy process than Cd^{115}. These results are explained in terms of the high-spin states of the fission fragments resulting both from the high bombarding energy and from the fission act proper. (auth)

5039

MEASUREMENT OF THE $C^{12}(p,\gamma)$ AND $C^{12}(d,n)$ EFFECTIVE CROSS SECTIONS FOR LOW ENERGY BOMBARDING PARTICLES. A. S. Deineko, A. Ia. Taranov, and A. K. Val'ter (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 5, 201-4(1957) Sept.

In this experiment a tube electrometer capable of measuring effective cross sections down to $\sim 10^{-31}$ cm^2 was used. This instrument is only slightly sensitive to the shape of the energy spectrum of the emitted particles. It yields absolute values directly and permits one to determine the sign of the radioactive emission. It can moreover be used to measure small as well as large radiation intensities without alteration of the geometry or the recording apparatus. The values of the yields for the reactions $C^{12}(p,\gamma)$ and $C^{12}(d,n)$ in thick targets in the energy range 300 to 400 kev agree satisfactorily with the shape of the analogous curves at energies above 400 kev. The measured cross section for the $C^{12}(p,\gamma)$ reaction in the 300 kev range is in good agreement with the value computed for this energy from the extrapolation formula. (auth)

5040

DEPENDENCE OF THE POLARIZATION OF (D + D) NEUTRONS ON THE ENERGY OF THE DEUTERONS. I. I. Levintov, A. V. Miller, E. Z. Tarumov, and Vn. Shamshev (Academy of Sciences, USSR). Soviet Phys. JETP 5, 310-12(1957) Sept.

5041

THE YIELD AND ANGULAR DISTRIBUTION OF FAST PHOTONEUTRONS FROM DEUTERIUM AND CARBON. P. S. Baranov, V. I. Goldanskii, and V. S. Roganov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1123-30(1957) Nov. (In Russian)

The yield and angular distribution of fast photoneutrons (of energy $\gtrsim$ 20 Mev) from nuclei of carbon and deuterium were investigated on the 265 Mev synchrotron. The results of experiments at photon energies both below and above the threshold for meson production are interpreted in terms of the two-nucleon model. (tr-auth)

5042

NUCLEAR REACTIONS OF N^{14} IONS WITH Li^7 AND C^{12} D. G. Alkhazov, Yu. P. Gangrskii, and I. Kh. Lemberg (Leningrad Inst. of Technical Physics, Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1160-2(1957) Nov. (In Russian)

In an investigation of the reaction products of the bombardment of Li^7 by nitrogen ions accelerated to 15.6 Mev, there were detected activities of F^{18}, Ne^{19}, N^{16}, and O^{15}, and in the bombardment of graphite, Al^{25} activity. The production cross sections of the above-mentioned reaction products are determined. On the basis of a comparison of the magnitudes of production cross sections of F^{18} in the bombardment of various light elements with nitrogen ions and the values of the binding energy of α particles in these nuclei, it is suggested that formation of F^{18} occurs by means of the incident N^{14} nucleus capturing an α particle out of the nucleus. (tr-auth)

5043

KNOCK OUT OF DEUTERONS FROM Li, Be, C AND O NUCLEI BY PROTONS OF ENERGY 675 Mev. L. S. Azhgirei, I. K. Vzorov, V. P. Zrelov, M. G. Meshcheryakov, B. S. Neganov, and A. F. Shabudin (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1185-95(1957) Nov. (In Russian)

A study is made of the momentum spectra of charged particles emitted in the bombardment of D, Li, Be, C, and O by protons of energy 675 Mev. The investigation was carried out by the method of magnetic analysis at an angle of 7.6° to the proton beam. A group of deuterons of energy about 600 Mev is found to be emitted for all elements. In the case of D, the source of fast deuterons is elastic (p–d)-scattering; in the remaining cases, deuterons are emitted in the reaction $p + (Z, A) \rightarrow d + p + (Z-1, A-2)$, which is proton scattering on quasi-deuteron groups inside nuclei. With an error of ~ 20%, the differential cross sections of this reaction are 2.9, 2.2, 3.7, and $4.6 \cdot 10^{-27}$ cm^2/sterad for Li, Be, C, and O, respectively. For the same nuclei, the mean energy of motion of the quasi-deuteron groups is evaluated at approximately 8, 11, 14 and 14 Mev. In the high-momentum part of the spectra, no perceptible quantities of knocked out tritium nuclei have been detected. In the passage of nucleons of a given energy through light nuclei, an essential role is played by the processes of three-particle interaction which are accompanied by large momentum transfer to the deuterons. The results are in accord with the concepts that underlie the high-momentum model of the nucleus. (tr-auth)

5044

ON THE FLUCTUATIONS OF NUCLEAR MATTER. D. I. Blokhintsev (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1295-9(1957) Nov. (In Russian)

The production of energetic fragments in collisions of fast nucleons with nuclei can be considered as the result of nucleon collisions with fluctuations of nuclear matter. (tr-auth)

Particle Accelerators

5045 AERE-GP/R-2184

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RESONANT CAVITY MEASUREMENT TECHNIQUES AT 400 Mc/s. W. Boyd. Aug. 1957. 19p.

Methods of measuring shunt impedance Q, and amplitude and phase variations in proton linear accelerators at a frequency of 400 Mc/s are described. (auth)

5046 AERE-GP/R-2189

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

GAS SCATTERING IN PROTON SYNCHROTRONS WITH VARIABLE RATE OF ACCELERATION. R. J. B. Hadden. Aug. 1957. 22p.

A modified gas scattering theory is given for machines with an acceleration rate which increases during the early acceleration time. The mean square amplitude of oscillation as a function of time or energy is obtained for the no loss case both with and without betatron damping. For greater than 50% loss of particles the damping is unimportant and the loss calculations are easy and accurate. For small losses the damping effect is important and loss calculations present greater difficulty. The values obtained by use of the Blachman small loss method should be reasonably accurate but will be checked by a digital computer program. Several existing and proposed machines are compared, with injection at 2 kilogauss/sec. rising to their respective present constant values in various intervals of time. Experimental evidence from the Bevatron at Berkeley is compared with theory and two contributions to the factor 2 to 3 discrepancy in the pressure for small losses are offered. (auth)

5047 AERE-T/R-2351

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

METHODS FOR A QUADRATIC NON-LINEAR RESONANCE. D. Morgan and R. Taylor. Sept. 1957. 28p.

The equation, $d^2x/d\theta^2 + q^2 x = \lambda x^2 \sin\theta$, with q close to $\frac{1}{2}$, which has application to spiral ridge accelerator dynamics, is examined using several methods. The results of a perturbation iteration method are compared with those of a special procedure which treats the difference $|q-\frac{1}{2}|$ as a perturbation. It is concluded that the iteration method is valid except very close to the $\frac{1}{2}$ resonance. The same method is applied in an appendix to the Mathieu Equation. (auth)

5048 NP-6562

Chr. Michelsens Institutt for Videnskap og Andsfrihet, Bergen.

ON THE THEORY OF THE LINEAR ACCELERATOR. Kjell Johnsen. Oct. 8, 1952. 138p.

The paper reports work done by the author in the field of linear accelerators during the last few years. A general theory of linear accelerators is presented. (A.C.)

5049 PLAC-4

Gt. Brti. Atomic Energy Research Establishment, Harwell, Berks, England.

AN AMPLIFIER VALVE DEPENDING ON THE MULTIPACTOR EFFECT AND THE MOTION OF ELECTRONS IN COMPOSITE D.C. AND A.C. FIELDS. R. E. Clay. Jan. 1954. 11p.

R-f power fed into a tuned cavity sets up the multipactor effect in the gap between the flat face of the central "post" and a perforated boundary wall. Electrons having an energy of approximately 1,000 volts emerge from the perforated wall into the gap of a second cavity. A d-c field of several kilovolts is maintained across this gap so that the

electrons acquire energy as they pass across it. The multipactor effect in the first cavity can operate only over a very narrow range of phase, hence it was expected that the beam emerging into the second cavity would be tightly bunched and a high efficiency of conversion from d-c to r-f power could be expected. (auth)

5050
ACCELERATORS. W. Zych (Inst. of Nuclear Research, Warsaw). Nukleonika 2, 427-49(1957). (In Polish)

Applications of accelerators in physics research and problems encountered in accelerator construction are discussed. Descriptions and characteristics are given for cyclic and linear accelerators, and for accelerators with constant accelerating potential. (R.V.J.)

5051
NON-LINEAR THEORY OF BETATRON OSCILLATIONS IN A STRONG FOCUSING SYNCHROTRON. Iu. F. Orlov. Soviet Phys. JETP 5, 195-200(1957) Sept.

A new method has been developed for investigating betatron resonances. Parametric resonances are investigated. (auth)

5052
PRODUCTION OF VERY STRONG MAGNETIC FIELDS BY RAPID COMPRESSION OF CONDUCTING SHELLS. Ia. P. Terletskii (Moscow State Univ.). Soviet Phys. JETP. 5, 301-2(1957) Sept.

For practical realization of cyclic accelerators of charged particles to energies in excess of 10^{10} ev, it is necessary to create very strong magnetic fields, in excess of 10^5 oersteds. At the indicated energies, both for electrons and for protons, the formula $V = 3.10^4$ RH holds, where V is the energy of the accelerated particles expressed in electron volts, R is the radius of curvature of the trajectory in meters, and H is the magnetic field intensity in oersteds. Consequently, in a cyclic accelerator for 10^{11} ev, with directing magnetic field $H = 10^5$ oersteds, the radius of the largest orbit must be 30 m, whereas with $H = 10^6$ oersteds it need be only 3 m. Thus only at fields exceeding 10^5 oersteds is there hope of building 100 Bev apparatus of not too huge dimensions. If magnetic fields can be created of intensities 10^7 to 10^8 oersteds, there is hope for the practical production of compact cyclic accelerators for energies exceeding even 100 Bev. The strongest magnetic fields have been obtained by passage of powerful current pulses of short duration through ironless electromagnets. Fields of the order of 3×10^5 have been obtained by the impulsive method. Further increase of the field is limited by the mechanical strength of the electromagnetic coils. An alternative of creating very strong magnetic fields would be the rapid compression of conducting shells or loops. By this method magnetic fields considerably stronger than the largest obtainable by the impulsive method are possible. It is believed that by the above method an initial field of 10^5 oersteds may be increased to 10^7 oersteds. (A.C.)

5053
ON ELECTRON LOSSES DUE TO PHASE OSCILLATIONS INDUCED BY RADIATION FLUCTUATIONS IN SYNCHROTRONS. A. N. Matveev (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1254-60(1957) Nov. (In Russian)

An effective calculation method for electron losses due to phase oscillations induced by radiation fluctuations is presented. Effects of nonlinearity are taken into account by means of boundary conditions. (tr-auth)

Radiation Absorption and Scattering

5054 NARF-57-61T
Convair, Fort Worth, Tex.
ANALYSIS OF AIR SCATTERING OF Co^{60} GAMMA RADIATION. J. W. Keller and G. Gonzalez. Dec. 28, 1957. 27p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-183).

The energy distribution of the singly scattered component of air-scattered radiation from a point isotropic source of monoenergetic gamma rays was calculated for comparison with measured spectral data for a Co^{60} source. The calculations were performed for a collimated detector. Comparison of measured and calculated spectra for collimator orientations of 10, 90, and 135° from the source-detector axis indicates that in general the observed spectra cannot be predicted satisfactorily in terms of the singly scattered component only. (auth)

5055 NDA-56-7
Nuclear Development Corp. of America, White Plains, N. Y.
A MONTE CARLO CALCULATION OF THE TRANSPORT OF GAMMA RAYS. M. H. Kalos. July 31, 1956. 44p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract AT-29. $7.70(ph OTS); $3.30(mf OTS).

A program for the calculation of the transport of gamma rays by Monte Carlo methods is described. It is concluded that the "doubling" technique and statistical estimation used in this program are simple and effective methods for improving the efficiency of the sampling. (auth)

5056
SCATTERING OF 9.5 Mev PROTONS BY NITROGEN. Anwar Hossain and A. N. Kamal (Dacca Univ., India). Indian J. Phys. 31, 553-9(1957) Nov.

The paper deals with the results obtained by the work on the scattering of 9.5-Mev protons by nitrogen. Nucleon emulsion technique has been employed for the detection of scattered particles. Levels in N^{14} nucleus has been obtained at 2.36 ± 0.03, 3.93 ± 0.05, 4.91 ± 0.03, 5.15 ± 0.02, 5.49 ± 0.02, 5.77 ± 0.03, 6.05 ± 0.02, 6.20 ± 0.03, 6.48 ± 0.05, 6.75 ± 0.03, and 7.01 ± 0.05 Mev. The angular distribution of the elastically scattered protons by N^{14} has been obtained. An asymmetric angular distribution has been obtained for the protons inelastically scattered by N^{14} leading to the formation of the 3.9-Mev level. (auth)

5057
HOW CHANNELING BETWEEN CHUNKS RAISES NEUTRON TRANSMISSION THROUGH BORAL. Walter R. Burrus (Lockheed Aircraft Corp., Marietta, Ga.). Nucleonics 16, No. 1, 91-4(1958) Jan.

The results of a calculation for the transmission of ⅛ by ¼ in. boral that considers the channeling effect are in much better agreement with experimental data than earlier calculations neglecting channeling. (auth)

5058
ENERGY AND ANGULAR DISTRIBUTION OF X-RAYS SCATTERED IN LEAD. J. H. Hubbell, E. Hayward, and W. F. Titus (National Bureau of Standards, Washington). Phys. Rev. 108, 1361-7(1957) Dec. 15.

The energy and angular distributions of the photons transmitted by thick lead barriers irradiated by 8- and 10-Mev bremsstrahlung beams have been measured by using a NaI(Tl) spectrometer. These distributions have been integrated over angle. The resultant energy distributions, after subtraction of the calculated annihilation radiation component, have been compared with the results of moments-method infinite-medium theory for plane monodirectional sources. Discrepancies of the order of 10% above 1 Mev and of the order of 50% below 1 Mev may be attributed, respectively, to omission of bremsstrahlung from the theory and the presence of a boundary in the experiment. An angular distribution of the transmitted energy indicated a nearly exponential falloff with angle. (auth)

5059

EXPERIMENTS ON ANTIPROTONS: ANTIPROTON-NUCLEON CROSS SECTIONS. O. Chamberlain, D. V. Keller, R. Mermod, E. Segrè, H. M. Steiner, and T. Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 108, 1553-6(1957) Dec. 15.

In this paper experiments are reported on annihilation and scattering of antiprotons in H_2O, D_2O, and O_2. From the data measured it is possible to obtain an antiproton-proton and an antiproton-deuteron cross section at 457 Mev (lab). Further analysis gives the $\bar{p}$-p and $\bar{p}$-n cross sections as 104 mb for the $\bar{p}$-p reaction cross section and 113 mb for the $\bar{p}$-n reaction cross section. The respective annihilation cross sections are 89 and 74 mb. The Glauber correction necessary in order to pass from the $\bar{p}$-d to the $\bar{p}$-n cross section by subtraction of the $\bar{p}$-p cross section is unfortunately large and somewhat uncertain. The data are compared with the p-p and p-n cross sections and with other results on $\bar{p}$-p collisions. (auth)

5060

EXPERIMENTS ON ANTIPROTONS: CROSS SECTIONS OF COMPLEX NUCLEI. L. E. Agnew, O. Chamberlain, D. V. Keller, R. Mermod, E. H. Rogers, H. M. Steiner, and C. Wiegand (Univ. of California, Berkeley). Phys. Rev. 108, 1545-53(1957) Dec. 15.

Experiments are described that have been designed to measure separately annihilation and reaction cross sections for antiprotons of approximately 450 Mev on oxygen, copper, silver, and lead. A new and more luminous spectrograph has been built for this experiment. The antiproton cross sections are compared with total proton cross sections, and are found to be larger by a factor varying from 1.74 for oxygen to 1.39 for silver. Calculations based on the optical model give a reasonable connection between these cross sections and the $\bar{p}$-p and $\bar{p}$-n cross sections. Finally, the information available on antiproton production cross sections is collected. There are indications that a free nucleon is several times as effective as a bound one for producing antiprotons. (auth)

5061

ANTINEUTRON PRODUCTION BY CHARGE EXCHANGE. J. Button, T. Elioff, E. Segrè, H. M. Steiner, R. Weingart, C. Wiegand, and T. Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 108, 1557-61(1957) Dec. 15.

Antineutrons produced by 440-Mev antiprotons incident upon Pb, C, and CH_2 targets have been observed. The antineutrons were detected by their energy release upon annihilation. Charge-exchange cross sections for antiprotons in the three targets have been calculated. The results show that the effective charge-exchange cross section per proton of the target nucleus decreases rapidly with increasing Z. (auth)

5062

SCATTERING OF HIGH-ENERGY ELECTRONS FROM C^{12} ON THE INTERMEDIATE-COUPLING MODEL. M. K. Pal and M. A. Nagarajan (Inst. of Nuclear Physics, Calcutta, India). Phys. Rev. 108, 1577-83(1957) Dec. 15.

The nuclear matrix elements of 1p-nuclei for intermediate coupling, which have been worked out in a previous paper, are used here in the case of C^{12} to calculate the elastic form factor and the inelastic form factor corresponding to the excitation of the nucleus to its 4.43-Mev level. For the 7.65-Mev level only the monopole transition matrix element has been calculated. The difficulty that has been faced in making a tentative 2^+ assignment to the 9.61-Mev level has been pointed out by discussing the observed magnitude of inelastic 4.43-Mev scattering and position of the 15.09-Mev (J = 1, T = 1) level. (auth)

5063

VACUUM POLARIZATION EFFECTS IN PROTON-PROTON SCATTERING. Loyal Durand, III (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 1597-1610(1957) Dec. 15.

The problem of vacuum polarization scattering of protons by protons is treated to first order in the vacuum polarization interaction. The phase shifts caused by the interaction are calculated, and the corresponding addition to the p-p scattering matrix is constructed. The phase shifts are calculated using Coulomb wave functions as the unperturbed wave functions. The corresponding addition to the p-p scattering matrix is then constructed, including exactly the Coulomb phase shift factors $\exp[2i(\sigma_L - \sigma_0)]$ appearing in the series representation of the scattering amplitudes. Other electromagnetic and relativistic modifications of the Coulomb scattering amplitudes are also examined in the limit of low energies. Numerical results are given for the vacuum polarization contributions to the p-p scattering cross section over the energy range 1.4–4.2 Mev. It is found that vacuum polarization scattering may easily be confused with nuclear P-wave scattering. (auth)

5064

RESONANT ABSORPTION OF GAMMA RAYS. S. S. Hanna and Luise Meyer-Schützmeister (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1644-5(1957) Dec. 15.

Several methods have been used to observe the resonant absorption or fluorescence when nuclei are irradiated by gamma rays. In this investigation a source of gamma rays was used with a discrete but variable energy to observe the resonant absorption by a direct measurement of the transmission through an absorbing sample. The energy of the incident particles is fixed. It is not necessary to use a reaction which is the inverse of the subsequent resonant absorption. (A.C.)

5065

SCATTERING OF FAST PROTONS ON PROTONS. D. I. Blokhintsev (Academy of Sciences, USSR). Soviet Phys. JETP 5, 284-5(1957) Sept.

It is shown that the main term in the interaction of two protons with J = 0 should have a singularity of the order $1/r^3$. (auth)

5066

POLARIZATION EFFECTS IN THE SCATTERING OF ELECTRONS AND POSITRONS BY ELECTRONS. A. A. Kresnin and L. N. Rozentsveig (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 5, 288-92(1957) Sept.

Polarization effects arising in the scattering of electrons or positrons by electrons are considered. A possibility is found for using Möller scattering in magnetized foils to analyze polarized beams of electrons or positrons. (auth)

5067

THE CONSTRUCTION OF A PHENOMENOLOGICAL SCATTERING MATRIX WITH NON-LOCAL INTERACTION. V. S. Barashenkov (Chief Administration for the Use of Atomic Energy). Soviet Phys. JETP 5, 313-15(1957) Sept.

5068

EFFECT OF A LONGITUDINAL MAGNETIC FIELD ON THE MULTIPLE SCATTERING OF PARTICLES. N. A. Cerenkov (United Inst. of Nuclear Studies). Soviet Phys. JETP 5, 320-1(1957) Sept.

5069

INTERNAL COMPTON EFFECT IN PAIR CONVERSION. E. G. Melikian (Moscow State Univ.). Soviet Phys. JETP 5, 331-3(1957) Sept.

If the energy difference between excited and ground

states is greater than 2 mc^2 (m is the electron mass), then a nucleus in the excited state may decay by emission of an electron-positron pair together with a photon. This process is called the internal Compton effect in pair conversion. Formulas are given for the relative differential probability of this process (i.e., the ratio of the absolute probability of interval Compton effect in pair conversion to the probability of a simple radiative transition), calculated in Born approximation. (A.C.)

5070
ON THE THEORY OF SCATTERING OF PARTICLES BY NUCLEI. I. G. Ivanter and L. B. Okun. Soviet Phys. JETP 5, 340-1(1957) Sept.

5071
ON THE BACKWARD ELASTIC SCATTERING OF 660 Mev PROTONS ON CARBON NUCLEI. G. A. Leksin and Yu. P. Kumekin (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1147-9(1957) Nov. (In Russian)

It is shown that the cross section of elastic scattering backwards of protons of energy 660 Mev on a carbon nucleus as a whole does not exceed 3×10^{-33} cm^2/sterad. In this connection, the mechanism is discussed on the ejection of fast fragments from nuclei when the latter interact with high-energy nucleons. (tr-auth)

5072
DIFFRACTION SCATTERING AND NUCLEON STRUCTURE. S. Z. Belenkii (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1248-50(1957) Nov. (In Russian)

The analysis of scattering of high-energy particles is made for the collision of two nucleons and for the collision of a π meson with a nucleon. It is shown that at high energies each of these processes is characterized by a single scattering amplitude. An essential role is played only by the imaginary part of such an amplitude which may be determined from experiments on diffraction scattering. (tr-auth)

5073
ON THE MEASUREMENT OF POLARIZATION MAGNITUDES. A. G. Zimin. Zhur. Eksp. Teoret. Fiz. 33, 1300 (1957) Nov. (In Russian)

5074
RADIATION CORRECTIONS IN DISPERSION RELATIONS FOR $\pi^+ + p \rightarrow \pi^+ + p$. V. K. Fedyanin (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1301-2(1957) Nov. (In Russian)

Attempts are made to determine the difference between $F^3(+)$ and $F^3(-)$ considering, in the total system of functions, the intermediate states in which nucleon and photon are present. (tr-auth)

5075
SCATTERING OF π^- MESONS ON HYDROGEN AT 333 Mev. V. G. Zinov and S. M. Korenchenko (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1307-8 (1957) Nov. (In Russian)

The elastic and exchange scattering of π^- mesons on hydrogen was studied with a π^--meson beam from a synchrocyclotron magnet. The energy of the incoming π meson was 333 ± 9 Mev. Corrections for differential cross sections for elastic scattering of π^- mesons and γ quanta from π^0 meson decay are presented in tabular form. (R.V.J.)

5076
SCATTERING OF π MESONS ON HYDROGEN WITH CHARGE EXCHANGE AT 307 Mev. V. G. Zinov and S. M. Korenchenko (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1308-9(1957) Nov. (In Russian)

The angular distribution of γ quanta from π^0-meson decay in exchange scattering of π mesons on hydrogen ($\pi^- + p \rightarrow \pi^0 + n$) was analyzed. Corrections for differential cross sections for γ quanta in π^0 meson decay in a mass-center system and curves of selected phase shifts are presented. Neither of the curves agrees with the observed angular distribution of γ quanta in π^0 meson decay. (R.V.J.)

Radiation Effects

5077 APEX-347
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
RADIATION EFFECTS ON THE G-E CERAMIC VACUUM TRIODE. J. Crittenden. Jan. 1958. 10p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.50(OTS).

It is concluded from calculations and a few experiments that radiation has no noticeable effect on the ceramic vacuum tube. (L.M.T.)

5078 NP-6560
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
ACCESSION LIST NO. 7 [ON RADIATION EFFECTS DATA]. Jan. 15, 1958. 35p. Project No. 2133. Contract AF33(616)-5171.

5079
EFFECT OF RADIATION ON SHOCK WAVE BEHAVIOR. R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Fluids 1, 24-9(1958) Jan.-Feb.

The fundamental conservation equations governing fluid dynamics and including radiation are written down. The Rankine-Hugoniot conditions are derived for shock waves subjected to radiation flux. Similarity solutions are obtained for the constant density and constant pressure cases. Some results are stated for the combined radiation-fluid dynamics corresponding to a power law dependence of the temperature on the time. (auth)

5080
CROSS SECTIONS FOR L-SHELL IONIZATION OF Ag BY PROTONS, DEUTERONS, AND ALPHA PARTICLES. B. Singh (Atomic Energy Establishment, Trombay, Bombay, India). Phys. Rev. 108, 1449-52(1957) Dec. 15.

A thin target of Ag is bombarded by protons, deuterons, and alpha particles of energies between 0.4 and 1.0 Mev. The charged particles are accelerated by a Van de Graaff machine and the resulting L x-rays of Ag are detected by a proportional counter of good resolution and high efficiency. The pulses from the counter are analyzed by a fifty-channel pulse-height analyzer and the number of x-ray quanta produced is determined by well-defined differential curves. After correcting for the Auger transition the absolute cross section for L-shell ionization is measured. The absolute cross section of L-shell ionization is larger than the K-shell ionization by a factor of 10^4 for the same proton energy. In the absence of a theoretical treatment for L-shell ionization, an empirical formula similar to the K-shell ionization formula is suggested. (auth)

5081
INVESTIGATION OF SLOW ELECTRON EMISSION INDUCED BY HIGH ENERGY PROTONS. E. S. Mironov and L. M. Nemenov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 188-91(1957) Sept.

An investigation has been carried out of the electron emission produced by high energy protons. The method is described. Values of the emission coefficients, γ_1 and γ_2 for aluminum and nickel in the energy range from 2 to 7.3 Mev are presented. (auth)

5082

RADIATION EFFECTS IN SOLIDS. G. J. Dienes and G. H. Vineyard. New York, Interscience Publishers, Inc., 1957. 233p.

This volume is concerned mostly with the physics of radiation effects, not with the chemistry of such effects, and not at all with biological effects. Displaced atoms have been given more prominence than ionization, and organic substances have been given less space than other types of solids. The volume is primarily concerned with γ-ray energies and higher. (W.L.H.)

Radioactivity

5083 CU-167

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. Pegram Lab.

THE BETA SPECTRUM OF He^6: LIMITS ON THE AXIAL VECTOR AND PSEUDOSCALAR COUPLING CONSTANTS OF BETA DECAY (thesis). Arthur Z. Schwarzschild. May 1, 1957. 131p. Contract AT-30-1-GEN-72. $19.80 (ph OTS); $6.30(mf OTS).

A careful measurement of the shape of the beta spectrum of He^6 was performed. A detailed study of the phenomenon of electron scattering in a thin lens magnetic spectrometer made it possible to interpret the spectrum shape from the end point at $W_0 = 3.50 \pm 0.02$ Mev down to $\frac{1}{14}$ $W_0 = 0.250$ Mev. The experimental shape was compared with the theoretically predicted shape for allowed spectra. The influence of the pseudoscalar interaction on the shape of the He^6 spectrum has also been considered. From these measurements, the limits on the Fierz interference in the Gamow-Teller interaction as well as on the magnitude of the pseudoscalar coupling constants were set. These limits have been interpreted in terms of the relative magnitudes of the axial vector and pseudoscalar and tensor coupling constants using the two component theory of the neutrino and assuming that the complete beta decay Hamiltonian proposed by Lee and Yang is or is not invariant under time reversal. The effect on the spectrum shape of the production of inner Bremsstrahlung in beta decay was calculated, and this effect was shown to be at the limit of experimental detectability. (auth)

5084

LIFETIME OF THE 247-kev EXCITED STATE OF Cd^{111}. P. C. Simms and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. 108, 1459-61(1957) Dec. 15.

It is shown that lifetime measurements of excited nuclear states may be influenced by extranuclear effects. By a proper choice of the chemical and physical form of the radioactive source this effect can be practically eliminated. Considering this extranuclear perturbation the lifetime of the 247-kev state of Cd^{111} has been determined as $\tau_N = (122.3_{-0.3}{}^{+1.2})$ millimicroseconds. Experimental evidence of the influence of extranuclear effects on lifetime measurements is presented. (auth)

5085

DECAY OF Ca^{38}. J. E. Cline and P. R. Chagnon (Univ. of Michigan, Ann Arbor). Phys. Rev. 108, 1495-6(1957) Dec. 15.

The decay of a new isotope, Ca^{38}, produced by the reaction $Ca^{40}(\gamma,2n)$, has been observed via branching of the beta decay to a 3.5-Mev excited state of K^{38}. The observed half-life of (0.66 ± 0.05) second is consistent with a log (ft) value of 3.5 for the ground-state transition. The tentative assignment for the K^{38} excited state is $J = 1^+$, $T = 0$ although $J = 0^+$, $T = 1$ is also possible. A search for branching in the decay of S^{30} is also discussed. (auth)

5086

POSITRON POLARIZATION IN A MIRROR TRANSITION. F. Boehm, T. B. Novey, C. A. Barnes, and B. Stech (California Inst. of Tech., Pasadena). Phys. Rev. 108, 1497-9 (1957) Dec. 15.

The positron polarization in the mirror transition N^{12}, a predominantly Fermi transition, has been measured by detecting the circular polarization of the annihilation-in-flight quanta. The results indicate complete polarization of the positrons parallel to their momentum, showing that Fermi coupling contributes significantly to the positron polarization in the same sense as the Gamow-Teller coupling. (auth)

5087

RADIATIONS FROM Ba^{133}. Bernd Crasemann, J. G. Pengra, and I. E. Lindstrom (Univ. of Oregon, Eugene). Phys. Rev. 108, 1500-5(1957) Dec. 15.

The decay of the isotope Ba^{133}, produced by pile neutron irradiation of Ba^{132}, has been studied with a magnetic lens and scintillation spectrometers. Gamma rays of 0.079, 0.302, and 0.355 Mev have been measured, with relative intensities 1.00 : 0.71 : 2.1 and K-conversion coefficients of 1.3 ± 0.5, 0.11 ± 0.07, and 0.07 ± 0.05, respectively. Conversion electrons from weak transitions of energies 0.158 and 0.276 Mev have been observed and assigned to Ba^{133}. Gamma-gamma coincidences have been measured and a decay scheme is proposed. The K/L capture ratio for Ba^{133} is shown to be greater than 1.5. (auth)

5088

ENERGY DEPENDENCE OF CROSS SECTIONS NEAR THRESHOLD: ONE NEUTRAL AND TWO CHARGED REACTION PRODUCTS. Robert W. Hart, Ernest P. Gray, and William H. Guier (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev. 108, 1512-22(1957) Dec. 15.

The energy dependence near threshold of cross sections for reactions leading to the escape of one neutral and two charged particles is determined. The method is an extension of one developed previously for uncharged particles, and utilizes only general properties of solutions of the time-independent three-particle Schrödinger equation valid outside a reaction zone of finite extent. Electron detachment from H^- by charged particle bombardment, and nuclear reactions of the type (n,np) are considered as examples. (auth)

5089

ANOMALOUS K^+ DECAY. G. Harris, Juliet Lee, J. Orear, and S. Taylor (Columbia Univ., New York). Phys. Rev. 108, 1561-3(1957) Dec. 15.

Out of 5000 K^+ mesons, one has been found with a π^+ secondary of 60 Mev which exceeds the 53-Mev upper limit for the alternate tau decay mode. In view of the estimate of Dalitz, it is reasonable that this be the first observed case of the possible decay mode: $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$. There is strong evidence against the possibility that this event is a τ' decay in flight, and also against the possibility that the secondary might be a μ^+ rather than a π^+. (auth)

5090

SOME CASES OF VERY SMALL LIFE TIMES OF LOW NUCLEAR LEVELS. E. E. Berlovich and G. V. Dubinkin (Academy of Sciences, USSR). Soviet Phys. JETP 5, 164-7(1957) Sept.

The life times of short-lived excited states of nuclei were studied by the delayed coincidence method. The life times of the lower levels of the Ti^{46} and Mo^{95} nuclei were found to be less than 10^{-10} sec. The experimental half life of the excited state of the Tl^{203} nucleus was found to be $(2.9 \pm 0.3) \cdot 10^{-10}$ sec, a result which does not agree with that of de-Waard. The method applied by de-Waard is dis-

cussed. The partial half times for magnetic dipole and electric quadrupole transitions are compared with the values predicted by the formulas of the single-particle model. (auth)

5091

NEW SHORT-LIVED ISOMERS IN THE MILLISECOND RANGE. O. I. Leipunskii, A. M. Morozov, Iu. V. Makarov, and P. A. Impol'skii (Academy of Sciences, USSR). Soviet Phys. JETP. 5, 305-6(1957) Sept.

Isomeric states with half lives in the millisecond range which resulted from interactions with 20-Mev protons have been investigated. Data were obtained concerning new isomeric radioactivity in a number of elements (Ge, Sr, Y, Zr, Hg, Cd). A tabulation of data is given. (A.C.)

5092

THE DECAY SCHEME OF $Bi^{212} \xrightarrow{\beta} Po^{212}$. A. G. Sergeev, E. M. Krisyuk, G. D. Latyshev, Yu. N. Trofimov, and A. S. Remennyi (Leningrad Inst. of Transportation). Zhur. Eksp. Teoret. Fiz. 33, 1140-3(1957) Nov. (In Russian)

On the basis of the conversion spectrum of an active precipitate of radiothorium, an attempt is made to verify the decay scheme of $Bi^{212} \xrightarrow{\beta} Po^{212}$. It is shown that aside from the well-known levels of 727.2, 1620.5, 1679.9, and 1800.4 kev, the decay scheme of Bi^{212} has a level with an energy of 1512.6 kev. Suppositions made in the literature concerning the existence of levels of 830, 2180, 2200, and 2230 kev were not confirmed. The possibility of the existence of vibrational levels in Po^{212} is discussed. (tr-auth)

5093

THE DECAY SCHEME OF Tl^{208}. E. M. Krisyuk, A. G. Sergeev, G. D. Latyshev, K. I. Ilin, and V. I. Fadeev (Leningrad Inst. of Transportation). Zhur. Eksp. Teoret. Fiz. 33, 1144-6(1957) Nov. (In Russian)

On the basis of the conversion electron spectrum, an attempt is made to verify the decay scheme of Tl^{208}. It is shown that the spin of the ground state of Tl^{208} is 5^+, while the spin of the 3.961 Mev level of Pb^{208} is 6^-. It is assumed that there exists a 3.750 Mev level with a spin of 7^-. All excited levels of Pb^{208} are explained by the excitation of one proton. (tr-auth)

Rare Earths and Rare-earth Compounds

5094

SPECTRAL COMPOSITION OF γ RADIATION FROM ELEMENTS OF THE URANIUM AND THORIUM FAMILY. T. I. Sisigina. (Inst. of Applied Geophysics, Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz, No. 12, 1484-90(1957) Dec. (In Russian)

Tables of spectral composition of γ radiation for uranium and thorium family elements (Bi^{212}, Tl^{208}, Th^{234}, Pa^{234}, Ra, Pb^{214}, Bi^{214}, Pb^{210}, Ac^{228}, Th^{228}, Pb^{212}) were developed on the basis of available data, and equations were derived for the γ energies of the elements. (R.V.J.)

5095

A DETERMINATION OF THE NUCLEAR MOMENTS OF Gd^{155} AND Gd^{157} FROM THE HYPERFINE STRUCTURE OF PARAMAGNETIC RESONANCE. A. A. Manenkov and A. M. Prokhorov (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1116-18(1957) Nov. (In Russian)

The nuclear spins ($^3/_2$) and the ratio of magnetic moments $\mu(Gd^{155}) : \mu(Gd^{157}) = 0.73 \pm 0.03$ are determined from the hyperfine structure of paramagnetic resonance in phosphorus SrS–Gd. From a comparison of hyperfine splittings in the spectra of Eu^{2+} and Gd^{3+} in phosphorus SrS, and employing for $\mu(Eu^{151})$ the value 3.6 nuclear magnetons, the values are obtained: $\mu(Gd^{155}) = 0.25$ $\mu(Gd^{157}) = 0.34$ nuclear magnetons. (tr-auth)

Shielding

5096 NAA-SR-1992

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GRAPHICAL AIDS IN THE CALCULATION OF THE SHIELDING REQUIREMENTS FOR SPENT U^{235} FUEL. R. L. Ashley. Nov. 15, 1957. 59p. Contract AT-11-1-GEN-8. $1.75(OTS).

The shielding requirements for spent U^{235} fuel (or gross fission products) can be determined by using a method in which a single predetermined energy represents the entire fission product gamma-ray spectrum. The data presented herein, in the form of a series of graphs, can be used to obtain the value of this energy. Having this energy, the requisite shielding calculations can be performed using linear absorption coefficients and buildup factors which correspond to this energy. In essence, this method for determining fission product shielding requirements has as its basis a scheme termed the "effective energy" concept in which the entire fission product gamma-ray spectrum is replaced by a single gamma-ray line, behaving exactly as the entire spectrum for the given parameters of irradiation and decay time, shield material and thickness. The equivalence stems from the procedure utilized in determining the effective energy, i.e., the gamma rays comprising the fission product spectrum present at the time of interest are individually attenuated through a given shield and the over-all dose rate attenuation determined. The effective energy corresponds to the particular gamma ray which, if present in the same intensity as the fission product spectrum, would result in an equivalent dose rate when confronted by the same shield. The fission product spectrum considered consists, for the most part, of gamma rays with energies equal to or greater than 1.60 Mev. Since the range of shield thicknesses analyzed is in the thick-shield category, it was unnecessary to consider gamma rays with lower energies as they would contribute negligibly to the dose rate at the shield surface. The range of exposure times considered is from 100 hours to 300 days, with decay times of from 20 min to 300 days. Monolithic shields of 6 to 12 in. of Pb, 5 to 12 ft of H_2O, 3 to 6 ft of ordinary concrete, and 2 to 4.25 ft of magnetite concrete are analyzed. A comparison of the results obtained using the effective energy method with several experimental measurements indicates that this method yields data which are consistently lower than measured values. The ratio of calculated to measured values generally is greater than 0.5, but less than 0.9, with the greater deviation occurring for cooling times less than 45 min. (auth)

5097 NARF-57-62T

Convair, Fort Worth, Tex.

SHIELD SYSTEM OPTIMIZATION—GRADIENT NONLINEAR PROGRAMMING. R. D. Sheffield. Dec. 30, 1957. 40p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-186).

A procedure is developed for minimizing a nonlinear function of n variables subject to inequality constraints. Under suitable assumptions concerning convexity of the functions, a unique minimum is attainable by the method. The technique is applied to optimization of the total weight of a divided shield system subject to a prescribed dose rate level permitted in the crew compartment and to reactor leakage constraints. The procedure consists of two phases: a dose rate reduction phase followed by an isodose-rate weight reduction phase. Provision is made for satisfying the reactor leakage constraints which are expressed as linear inequalities. The process is iterative

and provides a convergence criterion depending upon equality of certain weight-dose coefficient ratios. (auth)

Spectroscopy

5098 AERE-C/R-1763

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EMISSION AND ABSORPTION SPECTRA OF PLUTONIUM EXCITED IN A KING FURNACE. L. F. H. Bovey and H. S. Wise. Dec. 20, 1955. 66p.

A list is given of wavelengths of Pu lines excited in a King type furnace and photographed in the second order of a 3m grating instrument. The problems connected with measurement of such lines are also briefly discussed. (auth)

5099

DOPPLER SLANT LINES OBSERVED IN AN AXIAL DISCHARGE IN A MAGNETIC FIELD. J. Rand McNally, Jr. and M. R. Skidmore (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 47, 863-4(1957) Sept.

Spectroscopic studies were made of the high intensity arc used in the large ORNL electromagnetic isotope separators (calutrons). The spectrum lines of ions and the recombination spectra of hydrogen ions show unusually marked broadening and a "slant line effect." This latter effect is attributed to a doppler shift due to the ordered rotation of ions about the arc column. (W.L.H.)

5100

THE ELECTRONIC STRUCTURE OF V-CENTERS. Theodore G.Castner and Werner Kinzig (Univ. of Illinois, Urbana and General Electric Research Lab., Schenectady, N. Y.). Phys. and Chem. of Solids 3, 178-95(1957).

By x-irradiation of alkali halides (LiF,NaCl, KCl, and KBr) at liquid nitrogen temperature electron defect centers are created which can be described as halogen molecule-ions oriented along the [110]-axes of the crystal. The electronic structure of this defect has been deduced from the hyperfine interaction studied by means of electron spin resonance. The detailed analysis of the electron spin resonance spectra together with experiments on alkali halides containing Tl^+ ions suggests that the halogen molecule-ion is not associated with any other imperfection. Thus, the defect might be regarded as a self-trapped hole. (auth)

5101

MEASUREMENT OF THE RELATIVE INTENSITIES OF γ-LINES BY A TWO-METER CRYSTAL DIFFRACTION γ-SPECTROMETER. O. I. Sumbaev (National Scientific Research Inst. of Metrology). Soviet Phys. JETP 5, 170-2 (1957) Sept.

Results of measurements of the relative intensities of a number of lines in the γ spectra of Ir^{192}, Ta^{182}, and Ta^{183} are presented. In those cases when the relative intensities have been measured by different methods, the data for the Ir^{192} spectrum obtained by a crystal diffraction spectrometer agree satisfactorily with the results derived from photo-electron and recoil electron measurements. (auth)

Theoretical Physics

5102 UCRL-4941

California. Univ., Livermore. Radiation Lab.

ION OSCILLATIONS IN A MAGNETIC FIELD. William A. Newcomb. July 30, 1957. 30p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The elementary theory of plasma oscillations, both of the electronic and ionic types, with no magnetic field is summarized. In particular, dispersion formulas are derived for both types, giving the frequency of the wave as a function of its wavelength. The analogous theory for ion oscillations in the presence of a uniform magnetic field is then worked out. (Electron oscillations are treated elsewhere in a similar manner.) A dispersion formula is derived, and some of its consequences are obtained, including a specification of the directions relative to the field in which propagation is possible for a given frequency. Next a wave equation for ion oscillations in the presence of both a magnetic field and a density gradient is derived. From this wave equation it is shown that the system is stable, at least within the approximations made in the highly simplified theory. The motion that is produced in the magnetic lines of force by an ion oscillation is calculated, and it is found that the lines oscillate with an amplitude much smaller than that of the charged particles. Finally, the general conditions under which lines of force can be expected to move with the particles and the conditions under which they cannot are discussed. (auth)

5103 UCRL-8096

California. Univ., Berkeley. Radiation Lab.

RELATIVISTIC TRANSFORMATIONS OF SPIN DIRECTIONS. Henry P. Stapp. Dec. 30, 1957. 8p. Contract W-7405-eng-48. $0.50(OTS).

Although the relativistic transformation of tensor quantities between various frames is simple, the transformation of the spin direction, a three-vector quantity, has caused some uncertainty. An attempt is made to clarify the situation by a short discussion on a practical level. The first part of the discussion is specifically related to spin-$\frac{1}{2}$ particles but the generalizations to higher spins are valid. In experiments concerning asymmetries related to polarization effects, it is convenient to describe the state of polarization by a three-dimensional polarization vector. The problem involved in defining the vector in the rest frame obtained by a direct Lorentz transformation of the laboratory frame to the velocity of the particle is discussed. Three cases are discussed in which some complications can be avoided. These are: the asymmetry of the μ decay in the π-μ-e chain when π is moving rapidly, the angular distribution from the decay of a spin-$\frac{3}{2}$ hyperon produced in a pion-nucleon collision, and the detection of the direction of polarization by means of a scattering process. (M.H.R.)

5104

RELATIVISTIC MAGNETOHYDRODYNAMICS. Edward G. Harris (U. S. Naval Research Lab., Wash.). Phys. Rev. 108, 1357-60(1957) Dec. 15.

The relativistic equations of motion for a conducting fluid in a magnetic field are formulated. A relativistically correct equation for the production of entropy due to Joule heating is derived from the conservation laws for mass, momentum, and energy. It is shown that both the energy density of the magnetic field and the magnetic pressure contribute to the inertia of a perfectly conducting fluid. The general dispersion relation for small-amplitude oscillations is found. (auth)

5105

RENORMALIZABLE THEORY FOR FERMI INTERACTIONS. Yasutaka Tanikawa (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 108, 1615-19(1957) Dec. 15.

A possible model for renormalizable Fermi interactions is discussed. In this theory, Fermi interactions are replaced by indirect two-stage processes which are transmitted by some Bose fields with zero spin having only renormalizable interactions with Fermi particles. (auth)

5106

SOLUTIONS OF THE STATIC THEORY INTEGRAL EQUATIONS FOR PION-NUCLEON SCATTERING IN THE ONE-MESON APPROXIMATION. George Salzman (Univ. of Rochester, N. Y.) and Freda Salzman. Phys. Rev. 108, 1619-28(1957) Dec. 15.

Numerical solutions of the one-meson approximation of the Low equations for elastic pion-nucleon scattering in the fixed-nucleon, extended-source theory are obtained with a Gaussian cutoff function. The validity of the method requires that the scattering amplitudes have no zeros in the complex plane other than at $z = \pm 1$. The functions obtained for the (3,3) and (1,1) states satisfy the Low equations within the accuracy of the method, but the (1,3) and (3,1) states are only approximately given. This difficulty with the (1,3) and (3,1) states is correlated with the development of a zero in the corresponding scattering amplitude well before physically interesting values of the parameters (coupling constant and cutoff) are reached. A best fit to the (3,3)-state data up to 170-Mev pion laboratory energy requires a coupling constant, f^2, less than 0.08. The solution is consistent with the (3,1)-state data, but gives a (1,1)-state phase shift of larger magnitude than experiment appears to permit. It is found that the cutoff function does not prevent strong interactions at very high energies. Their occurrence appears to be a property of the static model. The contributions of such interactions to various static-theory calculations is briefly discussed. It is shown that in the p-wave part of the relativistic dispersion relations, where there is no cutoff function, if use is made of the low-energy data, then the very high-energy contributions of the static theory are replaced by recoil terms of order μ/M. (auth)

5107

APPLICATION OF DISPERSION RELATIONS TO S-WAVE MESON-NUCLEON SCATTERING. Katsumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1629-36(1957) Dec. 15.

Relativistic dispersion relations derived by Chew et al. are used to study the energy dependence of the S-wave phase shifts in low-energy meson-nucleon scattering. We carry out an S- and P-wave analysis and an S-, P-, and D-wave analysis under the assumption that the (3,3) resonance dominates the dispersion integral. Taking more accurately into account the recoil effects of the nucleon improves the agreement of the energy dependence of the S-wave phase shifts with experiment. The P-wave scattering lengths are determined numerically. (auth)

5108

MODIFIED PLANE WAVES AND REARRANGEMENT COLLISIONS. M. N. Hack (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1636-41(1957) Dec. 15.

The use of modified plane waves as initial- or final-state basis vectors in the calculation of transition amplitudes for scattering problems is justified in a general manner by time-dependent and time-independent methods. Expressions for the S matrix in terms of modified plane waves are derived for rearrangement collisions. An equivalence theorem is obtained, by means of which the S matrix can be expressed in a variety of alternative forms. (auth)

5109

TWO LIMITING MOMENTA IN SCALAR ELECTRODYNAMICS. L. P. Gor'kov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 167-9(1957) Sept.

A study is made of the possibility of introducing two limiting momenta in scalar electrodynamics. It is shown that the difficulties connected with the vanishing of the renormalized charge in the limit of a point interaction appear also in the theory considered here. (auth)

5110

LEVEL SHIFTS IN HELIUM. THREE BODY FORCES. G. F. Filimonov (Moscow State Univ.). Soviet Phys. JETP 5, 192-5(1957) Sept.

A fourth order expression containing three-body forces is obtained for a two-field interaction Hamiltonian. An expression is obtained for the energy matrix element of triple collisions between two electrons and an α particle, and computations are performed for the 1^1 S state of helium. The resulting shift is found to be 1.02 ± 0.15 cm^{-1} and does not remove the discrepancy between theory and experiment. Some effects which might be invoked to bring the theory into agreement with experiment are discussed. (auth)

5111

SOME REMARKS ON THE VALIDITY OF THE HYDRODYNAMIC DESCRIPTION OF QUANTUM SYSTEMS. D. I. Blokhintsev (Academy of Sciences, USSR). Soviet Phys. JETP 5, 286-7(1957) Sept.

It is shown that the hydrodynamic description of quantum systems imposes some serious restrictions on the dimensions of the investigated system. A result of this is that the description is not valid for atomic nuclei or multiple creation of mesons at the initial stages of expansion of the meson liquid. (auth)

5112

PARTICLE WITH SPIN 3/2 IN AN ELECTROMAGNETIC FIELD. E. E. Fradkin (Leningrad State Pedagogical Inst.). Soviet Phys. JETP 5, 298-9(1957) Sept.

5113

THE PROBLEM OF PARITY NON-CONSERVATION IN WEAK INTERACTIONS. B. L. Ioffe, L. B. Okun', and A. P. Rudik. Soviet Phys. JETP 5, 328-30(1957) Sept.

5114

THE MOMENTUM DISTRIBUTION OF INTERACTING FERMI PARTICLES. A. B. Migdal. Soviet Phys. JETP 5, 333-4(1957) Sept.

5115

A GROUP THEORETICAL CONSIDERATION OF THE FIRST PRINCIPLES OF RELATIVISTIC QUANTUM MECHANICS. II. A CLASSIFICATION OF IRREDUCIBLE REPRESENTATIONS OF AN INHOMOGENEOUS LORENTZ GROUP. Yu. M. Shirokov (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1196-1207(1957) Nov. (In Russian)

A classification has been obtained of the states of a relativistic quantum system. The irreducible representations of an inhomogeneous Lorentz group are divided into four basic classes P_m, P_{II}, P_0, Q_0. All representations of classes P_m, P_{II}, both unitary and non-unitary, are obtained in the explicit form. (tr-auth)

5116

A GROUP THEORETICAL CONSIDERATION OF THE FIRST PRINCIPLES OF RELATIVISTIC QUANTUM MECHANICS. III. IRREDUCIBLE REPRESENTATIONS OF CLASSES P_0 AND Q_0 AND NOT FULLY REDUCIBLE REPRESENTATIONS OF AN INHOMOGENEOUS LORENTZ GROUP. Yu. M. Shirokov (Moscow State Univ.). Zhur. Eksp. Teoret. Fiz. 33, 1208-14(1957) Nov. (In Russian)

All unitary and nonunitary irreducible representations of class P_0 of an inhomogeneous Lorentz group are obtained in the explicit form. The isomorphism of representations of class Q_0 and representations of a homogeneous Lorentz group is considered. Certain not fully reducible representations of an inhomogeneous Lorentz group that are of physical interest are indicated. (tr-auth)

5117
INVERSE DISPERSION RELATIONS. V. Z. Blank and D. V. Shirkov (Joint Inst. of Nuclear Research). Zhur. Eksp. Teoret. Fiz. 33, 1251-3(1957) Nov. (In Russian)

Inverse dispersion relations connecting the imaginary part of the scattering amplitude with a Cauchy-type integral of the real part of the scattering amplitude are considered. The integral over the unobserved region is calculated using ordinary (direct) dispersion relations. The forward-scattering amplitude of charged pions on nucleons is discussed and the physical inverse dispersion relations that do not contain unobservable quantities are written down in the explicit form. (tr-auth)

5118
ON THE INVARIANT REPRESENTATION OF THE SCATTERING MATRIX. V. I. Ritus (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1264-7(1957) Nov. (In Russian)

The scattering matrix S for a reaction of the type $a + b \rightarrow a' + b'$ is expressed by a finite number of spin operators Q_i which are invariant with respect to rotations and reflections. A procedure is given for constructing operators Q_i; their number is determined for reactions with given initial and final spins. The limitations are considered that are imposed on the form and number of operators Q_i by the condition of invariance of the scattering matrix against the time reversal. Examples are given of the representation of S by means of operators Q_i for a number of reactions. (tr-auth)

5119
APPLICATION OF THE DISPERSION RELATIONS FOR DETERMINATION OF BOUND STATES. V. I. Serdobolskii (Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1268-70(1957) Nov. (In Russian)

Dispersion relations are discussed in the framework of nonrelativistic theory. It is shown that the energies, parities, and certain spectral coefficients characterizing the bound states of the system can be determined on the basis of scattering data. Some characteristics of the deuteron are determined by using the n–p-scattering data. (tr-auth)

5120
AGING EQUATION FOR γ-QUANTA. B. V. Novozhilov (Inst. of Chem. Physics, Academy of Sciences, USSR). Zhur. Eksp. Teoret. Fiz. 33, 1287-9(1957) Nov. (In Russian)

An equation is obtained for the distribution function of multiply scattered γ quanta of low energy ($E \ll m_0c^2$) similar to the aging equation for neutrons. The distributions found of quanta over the space and over the wavelengths are in satisfactory agreement with the numerical solution of the kinetical equation. (tr-auth)

Uranium and Uranium Compounds

5121 BMI-1014
Battelle Memorial Inst., Columbus, Ohio.
ARC MELTING AND CONTINUOUS CASTING OF 7-INCH-DIAMETER URANIUM INGOTS. Henry A. Saller, Ronald F. Dickerson, Ellis L. Foster, and Walter J. Hildebrand. July 11, 1955. Decl. Feb. 3, 1958. 17p. Contract W-7405-eng-92. $0.75(OTS).

A large arc furnace capable of continuously casting 7-in.-diameter uranium ingots was constructed and successfully operated. Melting rates of between 200 and 300 lb per hr were obtained. (auth)

5122 MCW-1405
Mallinckrodt Chemical Works, St. Louis.
THE REFLECTIVITY OF ORANGE OXIDES. B. A. Swinehart. Nov. 15, 1957. 27p. Contract W-14-108-eng-8. $0.75(OTS).

One of the basic problems associated with the production of uranium tetrafluoride is the varying reactivity of uranium trioxide (orange oxide). Separate batches of material produced by the same method may be so dissimilar that they require different sets of reaction conditions for satisfactory processing. Orange oxide (UO_3) is almost invariably a mixture of several different types. "Reactivity" is the term applied to the behavior of a given orange oxide with respect to its reduction to UO_2 and subsequent hydrofluorination to UF_4. Assuming constant reaction conditions, it is thought that the reactivity of an orange oxide depends to varying degrees on the chemical composition and the physical makeup of the oxide. The visual examination of numerous samples of UO_3 suggested that the color of the oxide could be directly related to some of its chemical and physical properties. From this it was deduced that color ought to be related to the reactivity of the oxide and if so its measurement would permit the desired rapid prediction of reactivity. Quantitative measurements of color were made in the visible region of the spectrum. These measurements were compared to experimentally determined reactivities. A simple rapid test was ultimately devised for predicting the relative reactivity of any given sample of UO_3. The method requires only two to four measurements of reflectivity and can be completed in 15 minutes. (A.C.)

5123
NONDESTRUCTIVE TESTING OF URANIUM. Gerold H. Tenney (Los Alamos Scientific Lab., N. Mex.). Am. Soc. Testing Materials Spec. Tech. No. 213, 36-48(1957).

The rapidly increasing peacetime application of nuclear energy will entail a corresponding increase in the use of uranium. The high physical density, nuclear characteristics, slightly different manufacturing methods, and greatly unorthodox specifications for uranium require special techniques of nondestructive testing. Uranium ranging in thickness from a few mils up to about 2½ in. has been radiographed successfully, using sources of different energies. Typical exposure charts, respective film-screen combinations, the use of vacuum cassettes, and the problem of shielding against object and room scatter are also included in this discussion. Furthermore, the use of radiation gages to measure the uniformity of mass per unit area and the application of ultrasonics are taken under consideration. The sensitivities of these various methods, which determine their use within a particular thickness range, are also mentioned. (auth)

5124
MASS DISTRIBUTION IN FISSION OF U^{235} BY RESONANCE NEUTRONS. R. Nasuhoglu, S. Raboy, G. R. Ringo, L. E. Glendenin, and E. P. Steinberg (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 1522-3(1957) Dec. 15.

Radiochemical analyses of samples of U^{235} irradiated with monoenergetic neutrons at 1.1, 3.1, and 9.0 ev indicated that the fission yield of Ag^{111}, Cd^{115}, and Sb^{127} relative to the yield of Sr^{89} does not change from that produced by thermal neutrons. (auth)

5125
SOFT 15-800 Kev RADIATION ACCOMPANYING THE THERMAL NEUTRON FISSION OF URANIUM. V. K. Voitovetskii, B. A. Levin, and E. V. Marchenko (Academy of Sciences, USSR). Soviet Phys. JETP 5, 184-8(1957) Sept.

A scintillation spectrometer investigation of the γ rays coincident with fission has established the presence of a series of lines. It has been shown that γ quanta having energies of 101, 119, 142, 207, 295, 360, 490, and 590 kev are emitted in fission. It is suggested that these γ quanta are

emitted by excited fragments following neutron emission. Intense radiation having a maximum at 27 kev apparently consists of the K x rays of heavy fragments. (auth)

5126

INVESTIGATION OF U^{235} FISSION γ RAYS IN THE ENERGY REGION UP TO 250 kev. V. V. Skliarevskii, D. E. Fomenko, and E. P. Stepanov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 220-5(1957) Sept.

A scintillation spectrometer with a NaI(Tl) crystal and a proportional counter connected in coincidence with a fission chamber was used to measure the U^{235} fission γ spectrum in the energy range up to 250 kev. Gamma rays with energies of 30 ± 1.5 and 210 ± 10 kev were detected, as well as a broad distribution in the 110 to 150 kev region, which apparently consists of several lines. It has been found that in the investigated energy region most of the fission γ rays are emitted by fission fragments with life times between 0.5×10^{-9} and 2.5×10^{-9} sec. The measurements made with the proportional counter showed that the line at 30 kev is not monochromatic and apparently corresponds to x radiation (K line) from heavy fission fragments with different Z. (auth)